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ST. GEORGE BASIN

ORIGINAL

Draft Environmental Impact Statement

COMPLETED
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PROPOSED OIL & GAS LEASE SALE 70

Alaska Outer Continental Shelf Office

I

This Environmental Impact Statement (EIS) is not intended, nor should it be used, as a local planning document, by potentially affected communities. The facility locations and transportation scenarios described in this EIS represent best estimate assumptions that were made for purposes of analysis and serve as a basis for identifying characteristic activities and any resulting environmental impacts. These assumptions do not represent a BLM recommendation, preference, or endorsement of any facility, site, or development plan. Local control of events may be exercised through planning, zoning, land ownership, and applicable state and local laws and regulations.

UNITED STATES
DEPARTMENT OF THE INTERIOR

DRAFT
ENVIRONMENTAL IMPACT STATEMENT
October 1981

Proposed
Outer Continental Shelf
Oil and Gas Lease Sale
St. George Basin

Prepared by
BUREAU OF LAND MANAGEMENT

Robt F Burford
Director, Bureau of Land Management

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Proposed Outer Continental Shelf
Oil and Gas Lease Sale
St. George Basin

Summary Sheet

(X) Draft ( ) Final

U.S. Department of the Interior, Bureau of Land Management, Alaska OCS Office, P.O. Box 1159, Anchorage, Alaska 99510.

1. Type of Action: Proposed Oil and Gas Lease Sale, St. George Basin.

(X) Administrative ( ) Legislative

2. Description of the Action: A total of 1,088,371 hectares (2.7 million acres) of OCS lands are proposed for leasing. The 479 blocks are located in St. George Basin 98.4 to 287.5 kilometers (61.1 to 178.6 mi.) offshore in water depths that range from 98 to 154 meters (321.5 to 505.3 ft.). If implemented, this sale is tentatively scheduled to be held in February 1983.

3. Environmental Impacts: All blocks offered pose some degree of pollution risk to the environment. The risk potential is related to adverse effects on the environment and other resource uses which may result principally from accidental or chronic oilspills. Socioeconomic effects from onshore development will have state, regional, and local implications.

Several alternatives and mitigating measures may be applied which would reduce the type, occurrence, and extent of adverse impacts associated with this proposal. Other measures, which are beyond the capability of this agency to apply, have also been identified. In spite of mitigating measures, some impacts are considered unavoidable. For instance, oilspills are considered statistically probable, some disturbance to fishery and wildlife values would occur, and some onshore development would occur in undeveloped areas. For each significant ecological resource, the probability of an oilspill impacting them has been given, based on an oilspill risk model.

4. Alternative to the Proposed Action:

a. No Sale (Alternative II).

b. Delay the Sale (Alternative III).

c. Modify the proposed sale area by deletion of 73 blocks near the Pribilof Islands (Alternative IV).

d. Modify the proposed sale area by deletion of 135 blocks near Unimak Pass (Alternative V).

e. Modify the proposed sale area by deletion of 208 blocks near the Pribilof Islands and Unimak Pass (Alternative VI).

5. Scoping Comments Were Requested From the Following:

Federal Agencies

- Department of Agriculture
  - Forest Service
- Department of Commerce
  - Bureau of Economic Analysis
  - National Marine Fisheries Service
  - National Oceanic and Atmospheric Administration
  - Office of Coastal Zone Management
  - Office of Ecological and Environmental Conservation
  - OCSEAP Office, Juneau

- Department of Defense
  - Air Force
  - Army Corps of Engineers
  - Department of the Army
  - Naval Operations
- Department of Energy
  - Alaska Field Office
  - Economic Regulatory Administration
  - Federal Energy Regulation Commission
  - Leasing Policy Development
- Department of the Interior
  - Bureau of Indian Affairs
  - Bureau of Land Management, State Director
  - Bureau of Mines
  - Fish and Wildlife Service
  - Geological Survey
  - Heritage Conservation and Recreation Service
  - National Park Service
  - Office of Aircraft Services
  - Special Assistant to the Secretary
- Department of Transportation
  - Coast Guard
- Department of the Treasury
- Environmental Protection Agency

State of Alaska

- The Honorable Jay S. Hammond, Governor
- Department of Administration
- Department of Commerce and Economic Development
- Department of Community and Regional Affairs
- Department of Environmental Conservation
- Department of Fish and Game
- Department of Health and Social Services
- Department of Labor
- Department of Law
- Department of Natural Resources
- Department of Public Works
- Department of Revenue
- Department of Transportation and Public Facilities
- Office of Coastal Management

Office of the Governor
    Division of Policy Development and Planning,
    State-Federal Coordinator

Universities

University of Alaska
    Department of Anthropology - Steve Langdon, Ph.D.
    Marine Advisory Program
Washington State University - Pullman
    Department of Rural Sociology - William Freundenberg, Ph.D.
University of California - Irvine, David Schneider, Ph.D. and George L. Hunt, Jr., Ph.D.
University of California - Santa Barbara, W. Holmes, Ph.D.

Native Organizations

Aleut Corporation
Aleutian/Pribilof Islands Association, Inc.
Association of Village Council Presidents
Bristol Bay Native Association
Ounalashka Corporation
Tanadgusix Corporation
Tanaq Corporation

Special Interest Groups

Acoustical Society of America
Alaska Center for the Environment
Alaska Conservation Society
Alaska Geological Society, Inc.
Alaska League of Women Voters
Alaska Miners Association
Alaska Oil and Gas Association
Alaska Professional Hunters Association
Alaska Public Interest Res. Group
Alaska Wildlife Federation and Sportman's Council, Inc.
Audubon Society, Anchorage Chapter and National Representative
Bertha's Brokerage
Chugach Gem and Mineral Society
Environmental Center, West Anchorage High School
Friends of Animals
Friends of the Earth
Geophysical Society of Alaska
Greenpeace Alaska
Isaac Walton League of America
Moening-Grey and Assoc., Inc.
Oil Watch
Resource Development Council
Rural CAP
Sierra Club
Trustees for Alaska
Wilderness Society

Additional Contacts

Advisory Council on Historic Preservation, Louis S. Wall

Aleutian Islands Region School District, Richard Bower, Superintendent
ATCO
Atlantic Richfield Company, Alaska, Inc.
Canadian Wildlife Service
Richard Careaga, City Planner, Unalaska
John Christensen, Port Heiden
Dames and Moore, Consultants
Marine Construction and Engineering Company
Pan Alaska Fisheries
Science Applications, Inc.
John Sevy, City Manager, King Cove and Sand Point

6. Technical Papers: This document makes extensive use of a series of technical papers prepared in the Alaska OCS Office (see Bibliography). The material contained in these papers is incorporated by reference throughout this EIS. Copies of these papers have been placed in a number of libraries throughout Alaska. Single copies of these technical papers are available from the Alaska OCS Office.

7. Contacts

For further information regarding this draft environmental impact statement, contact:

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8. Public Hearings

Public hearings are tentatively scheduled to be held in March or April of 1982. Exact dates and locations will be announced.

ST. GEORGE BASIN

OCS Sale 70

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*Major scoping issue.

Summary of Environmental Impact Statement for Proposed Sale 70

This environmental impact statement examines a proposal for oil and gas leasing in St. George Basin, alternatives to the proposal, major issues determined through the scoping process as well as staff analyses, and potential mitigating measures. The proposal consists of 479 blocks (approximately 2.7 million acres) which may be offered for lease in the St. George Basin, 61 to 179 miles offshore in water depths from 322 to 505 feet.

The probable impacts are based, in part, on the assumption that the mean resource estimate of 1.12 billion barrels of oil and 3.66 trillion cubic feet of gas would be discovered and produced in the proposed lease sale area. For this amount of oil, according to the U.S. Geological Survey, up to 6.5 oilspills exceeding 1,000 barrels are probable over the 22-year production life of the oil field. There is only a 28-percent chance that commercial quantities of oil would be found, or in other words, a 72-percent chance of not finding oil. If no oil is discovered, of course, there is no risk from potential oilspills or the range of development impacts discussed.

Put forth in this environmental impact statement are the proposal for offering 479 blocks for leasing in the St. George Basin and five alternatives to this proposal. These five alternatives are: no lease sale; delay the lease sale for 2 years; delete 73 blocks nearest the Pribilof Islands; delete 135 blocks located nearest the Unimak Pass; delete 208 blocks located nearest the Pribilof Islands and the Unimak Pass (a combination of the previous two alternatives). These are the various actions which are being assessed in this document. The Secretary of the Interior will decide which of these options or combination of options should take place.

The four developmental and transportation scenarios, described below, were discussed in this EIS to represent the wide range of various approaches to producing and shipping a hydrocarbon product, if discovery and, subsequently, development and production should take place in the St. George Basin. One of these four scenarios was used to assess impacts for the proposal and alternatives. The developmental scenario includes a terminal facility on the south side of the Alaska Peninsula. By analyzing one common scenario for all alternatives, the reader can more easily differentiate between alternatives. The effect of different scenarios within each alternative is also addressed in this document. The Secretary, in his decision to hold a sale in the St. George Basin, will not be prescribing a specific transportation scenario. The eventual development scenario will be dependent upon the presence of a commercial quantity of oil and gas, size of field, economics, land ownership, and many other factors. The selection of a specific scenario cannot be made at this time, nor is it a decision of the Secretary. It is true that the likelihood of one type of scenario over another is at least partially dependent upon the alternative selected. It should be emphasized that local communities could have a major influence on the final configuration of the transportation scenario through zoning, land use planning, and local laws and regulations.

As was stated before, the transportation scenario for common use in impact analysis for all alternatives hypothesizes processing and terminal facilities on a bay located on the southern shore of the Alaska Peninsula. Produced oil and gas could be transported from the St. George Basin by pipeline across the Alaska Peninsula to a bay on the south side. A second scenario hypothesizes construction of one or more processing and loading facilities on the Pribilof Islands; the third discusses onshore facilities near Makushin Bay (Unalaska Island); and the fourth hypothesizes the offshore processing and loading of all produced hydrocarbons. This summary of impacts is based on the south side of the Alaska Peninsula scenario. If another development scenario were selected, regional impacts would be expected to shift.

The impact assessment assumes that all laws, regulations, and OCS orders are part of the proposal. If the mitigating measures described in Section II.B. 1.c. were adopted, it is expected that some impacts described in this environmental impact statement would be reduced. Potential effectiveness of the mitigating measures is described in each impact section.

The following discussion covers the types of impacts expected from Alternative I to resources which were identified as major concerns in the scoping process.

The extent to which an oilspill would impact demersal fish would depend upon several factors. The eggs and larval stages of these species are the most vulnerable to oil. The probability of an oilspill contacting egg/larval halibut, yellowfin sole, Pacific cod, sablefish, and immature rockfish would be very unlikely. Walleye pollock eggs and larvae could be exposed to oil should a spill occur during the approximate 6-month period from spawning to onset of demersal existence (March-August annually). For pollock, the risk is moderate for spill contact, but insignificant when total pollock egg/larvae distribution and numbers are considered. All north Alaska Peninsula salmon species (principally sockeye) adult and smolt, could be adversely affected by this proposal, principally through interference during offshore migration. Impacts could also occur through reduction in food supply should oilspills reach estuaries. Pink and chum salmon would be the principal salmon species impacted by a tanker loading facility in any one of the bays on the south Alaska Peninsula. Oilspills in these bays could block migration and/or reduce food for both adults and smolt.

The adverse impacts are expected to be largely short-term and recovery thereafter would probably occur after no more than 5 years. The described impacts are not expected to have any significant long-term impact on the salmon resources of Bristol Bay or the south Alaska Peninsula. The probability of interaction is rated as unlikely. Should an interaction occur significant impacts would be unlikely. The overall probability of significant impact is unlikely.

While much of the total Bering Sea crab population remains within the range of possible oilspill impact, only about 5 percent of the combined catch of king and tanner crab are harvested from within the proposed lease areas of the St. George Basin and North Aleutian Shelf. Pavlof, Ikatan, and Morzhovi Bays on the south Alaska Peninsula contain commercial numbers of king, tanner, and dungeness crab. In these relatively confined areas, oilspills could have a significant impact especially on larval forms. Crab of the eastern Bering Sea are distributed over a relatively wide area, thus the risk that an oil pollution event would contact any large part of the total population would be less than for the previously mentioned bays. Some crab mortality could occur during an offshore pipeline installation. Pipelines may act as physical and thermal barriers to crab migrations. Pipe design and installation could provide a solution to these impacts. Already severely depressed shrimp populations in Ikatan, Morzhovi, Pavlof, and Cold-Belkofski Bays on the south Alaska Peninsula could be reduced by chronic or large oil pollution events resulting from developing any one of these areas as a pipeline terminus and associated tanker loading port. The eastern Bering Sea has some pandalid shrimp, but spawning areas are outside the boundaries for any projected spills. Oilspills, reduced fishing area, vessel and gear conflicts, and competition for onshore facilities could all impact the commercial fishery in the eastern Bering Sea and off the south Alaska Peninsula. Oilspills could adversely affect very localized populations of commercial species over short time periods. Area and material conflicts would be local, short-lived, and minor to the fishery as a whole. Probability of interaction is likely; the impacts would be insignificant if interaction occurred. The overall probability of significant impact is unlikely.

Seabirds and waterfowl are extremely sensitive to both oil pollution and disturbance due to increased human activity. Most importantly, a low reproductive rate in murres, auklets, and other alcids may preclude a substantial loss of breeding adults which could result from contact with even a relatively minor oilspill. Since they spend much time foraging or resting on the water, alcids are highly vulnerable to oiling, while waterfowl and shearwaters are somewhat less so. Man-made disturbance, particularly aircraft and human presence, may result in decreased productivity at breeding colonies. At no time is the St. George Basin area devoid of large numbers of birds, but clearly the greatest number occur during the breeding season, May to October, when vast numbers of seabirds are foraging near the nesting colonies in the Pribilof Islands, eastern Aleutian Islands, southwest Alaska Peninsula, and Unimak Pass. Waterfowl populations are most vulnerable during spring and fall migration and the post-breeding molt period, when large numbers gather in the lagoons along the north side of the Alaska Peninsula. Oil and gas industry activities could seriously impact bird populations utilizing shelf areas adjacent to the north Alaska Peninsula shore and Unimak Island from May to September, lagoons of the north peninsula shore in spring and fall, and areas adjacent to the peninsula's south side in both winter and summer. Significant impacts in the areas used by birds near the Pribilof Islands would be likely if support facilities were located on St. Paul Island. Significant impacts on migratory species utilizing Izembek Lagoon would be unlikely unless oil were to enter the lagoon. If interaction were to occur, significant impacts are very likely for certain vulnerable species populations. The overall probability of significant impacts would be unlikely.

Two types of impacts could affect marine mammals in the proposed sale area: environmental contaminants, chiefly oil pollution, and disturbance due to increased human activity. The northern fur seal and the sea otter are the species most vulnerable to impacts from the proposed action. Both rely on fur insulation to maintain body temperature. This insulation would break down upon oiling of the animal. The northern fur seal has a large proportion of its population breeding in the vicinity of the proposed sale area. As a result of pipeline transport of oil across the Alaska Peninsula and tankering from a south side bay, oil and gas industry activities could impact marine mammals utilizing three areas: 1) lagoons and nearshore areas adjacent to the north peninsula shore and Unimak Island, year round; 2) reefs, islands, and nearshore areas adjacent to south shore of the Alaska Peninsula, year round; 3) a broad offshore corridor south of the peninsula to the eastern Aleutian passes in spring and fall. North of the Alaska Peninsula, sea otters would likely incur significant impacts due to their extreme sensitivity to oil, relatively sedentary population, and concentration in this area. Sea lions and harbor seals would not likely experience significant impacts, although contact with oil in areas of high density and breeding activity (Amak Island and Izembek Lagoon) could produce significant local impact. Fur seals migrating offshore would not likely encounter oilspills. If interaction were to occur, such a small percentage of the total population would be involved that a significant impact is considered unlikely.

Major impact-producing agents affecting endangered cetaceans and birds could be oil and gas pollution, noise or other disturbance, and habitat losses. Only portions of the populations of sei, fin, humpback, blue, and sperm whales are suspected of entering the Bering Sea and significant population-wide direct effects would be unlikely even if spills were to occur. Concentrations of gray whales are found in Unimak Pass, along the north side of Unimak Island and along the Alaska Peninsula during spring, and in the northeastern portion of the proposed lease area in fall. Based on oilspill risk analyses, it can be concluded that it is very likely that oilspills would interact with endangered cetaceans or their habitat. It is unlikely that such interaction, if it occurred, would significantly affect endangered whale populations frequenting the area. Therefore, it is unlikely that significant interactions would occur. The unlikely event of a large spill intersecting the gray whale migration is probably the only potential oilspill event that could possibly have a significant impact on an endangered whale population. The overall probability of significant impacts to cetaceans is unlikely. It is unlikely that oilspills would significantly interact with or affect endangered avian species.

In considering population growth and its related impacts, St. Paul, Unalaska, and Cold Bay are the communities most likely to be affected by OCS development. If a terminal facility were located on the south side of the Alaska Peninsula, Cold Bay would have the greatest population effects. OCS-related population would contribute 39 percent (211 persons) of the total population of 543 by 1985 and 56 percent (538 persons) of the total population of 960 persons in 1990. In St. Paul, OCS-induced population would constitute 1 percent or less (less than 10 persons) of total population over the life of the field. Population effects in Unalaska would be most apparent during the initial development phase, when Unalaska serves as a staging area for offshore marine support operations. In 1985, OCS-induced population constitutes 15 percent (528 persons) of the total population of 3,473. Although numerically large in relation to the existing population of about 1,300, the proportion of population induced by OCS operations to total projected population is reduced as a result of the rapid growth of the bottomfishing industry in Unalaska. Consequently, it is likely that significant population impacts could result from the proposal in Cold Bay but unlikely in Unalaska and on the Pribilof Islands.

Significant impacts on local subsistence resources from OCS-induced population would be unlikely in Cold Bay, Unalaska, and the Pribilof Islands. Short-term interaction of subsistence resources with the effects of offshore oilspill incidents would be likely on the Pribilof Islands, very unlikely west of Unimak Pass, and unlikely east of Unimak Pass, although terminal operations on the south side of the Alaska Peninsula could increase the likelihood of local interaction there. The probability of significant impacts on subsistence is likely on the Pribilof Islands should interaction occur, to an extent of possibly reducing meat supply by 30 to 50 percent. This possible reduction would be related to the scientific management of the fur seal population on the Pribilof Islands. Consequently, there is a likely probability of significant impacts on subsistence over the life of the field on the Pribilof Islands and an unlikely probability elsewhere.

Fishing is the basis for village livelihood north and south of the Alaska Peninsula. Among the villages in this area, Nelson Lagoon and False Pass would be more susceptible to the effects of an oilspill than the larger villages of King Cove and Sand Point by virtue of more localized fishing and sole dependency on salmon fishing. Drift and set gillnet fishermen from Nelson Lagoon and False Pass and drift gillnet fishermen from King Cove and Sand Point could be most affected by an oilspill incident from the proposal. A terminal located on the south side of the Alaska Peninsula could increase the risk to salmon fishing grounds located there.

The sociocultural systems of the towns and villages potentially affected by the proposal differ greatly, from Aleut sealing and fishing villages to the boomtown of Unalaska and the frontier settlement of Cold Bay. It is unlikely that significant impacts on sociocultural systems may accrue from the proposal directly in Unalaska or indirectly in any of the fishing villages located east of Unimak Pass. Significant impacts to the sociocultural systems of Cold Bay could result from a terminal sited on the south Alaska Peninsula. If a terminal were sited on the Pribilof Islands, significant impacts on those islands would very likely result.

In general, the community infrastructure requirements are directly related to population growth in the communities and their associated regions. It is easy to see that this population growth is directly related to the direction that oil and gas development would take. St. Paul and the Pribilof Island region would experience minimal additional demands on its infrastructure. The overall probability of significant impacts in St. Paul would be very unlikely. Unalaska's projected demands for housing, educational facilities, sewage system, solid waste disposal, health care, police protection and communication facilities are within the projected base case range and could be adequately met. This projected base case contains large growth predictions associated with the bottomfishing industry. Cold Bay could experience substantial impacts on its community infrastructure due to the high numbers of OCS workers that would likely shuttle through the community. The lack of a formal government would make the additional demands in service more severe than normally would be expected.

Impacts on offshore cultural resources, such as middens, burins, arrowheads, and lamps would most likely occur in the 17 blocks nearest the Pribilof Islands which have a high probability of prior human habitation. The 99 blocks nearest Unimak Pass have a high probability of containing shipwrecks which could be of cultural or historic value. Significant impacts on onshore cultural and archaeological sites would likely occur from increased population due to OCS support facilities. This population increase would mean more visits to cultural, archaeological, and religious sites and, subsequently, possible damage, destruction, looting, or wear to these sites. The final probability of significant impact for any submerged site is estimated to be unlikely. The final probability of significant impact due to increased interaction of the population with onshore cultural resources would be likely.

OCS employment impact in the Aleutian Islands Census Division would begin in 1983, rise very rapidly to a peak in 1987, and drop rapidly thereafter to a 1991 level less than 30 percent that of 1987. After 1991, employment changes would be more gradual. With the location of a terminal on the south side of the Alaska Peninsula, employment impact would peak in 1987 at about 6,400 jobs, most of which would be jobs offshore or in uninhabited locations onshore, and would be filled by nonresident workers who would commute during rest periods to residences outside the census division. The community most affected by this scenario would be Cold Bay with a possible 749 new jobs.

Unalaska could realize about 520 new jobs. Both of these towns have current low unemployment rates, so most of the jobs would be filled by commuters and new residents. St. Paul could obtain 37 new jobs of which 17 positions could be filled by local residents. This small increase in jobs would appear to have noticeable social and economic benefits, viewed in the context of existing unemployment at St. Paul. If the bottomfish industry develops as forecasted, the non-OCS future of the communities of Cold Bay, Unalaska, and St. Paul will provide ample opportunities for employment. One highly probable adverse result of OCS development, even in the absence of the projected expansion of bottomfish activity, would be increased rates of inflation in the impacted communities. Alaska Statutes could provide rent control protection. However, there appears to be no remedy for the very likely increase in price rates for commodities, including food. This could cause hardship among some area residents. In terms of effects on the entire census division, the probability is very likely that this development will have a significant impact in increasing the total number of jobs. However, the probability of significantly reducing unemployment is very unlikely due to the existing low levels of unemployment in most communities.

For the south side of the Alaska Peninsula scenario, impacts on airport and marine facilities of the Pribilof Islands would be minimal. At Dutch Harbor/Unalaska, OCS-induced air traffic would equal one-third of the projected baseline passenger traffic for that terminal. Planned improvements for the Dutch Harbor/Unalaska airport may allow for this increase. The majority of marine impacts would likely occur in the Dutch Harbor/Unalaska area. Significant marine impacts would decrease through time as OCS-support ships and tankers become a decreasing percentage of total vessel traffic as a result of the expanding bottomfishing industry. Cold Bay airfield could require minor facility upgrading to provide for passenger processing and, in the case of expected periods of poor weather, sleeping and eating facilities for work crews stranded on their way to and from work sites. The approaches to some of the bays on the south side of the Alaska Peninsula have shoals and other obstacles which would have to be considered in traffic lane design, if a terminal were to be located in this area. The overall probability of significant impact on the transportation systems of the area as a result of the proposal could be considered as very likely.

The proposed lease sale may have some impact, not necessarily adverse, on the district coastal management program once it is completed. Without knowledge of the possible goals and objective statements for the district coastal management programs regarding OCS facility siting, it is only possible to state that a conflict of some undefined type and intensity could occur.

Alternative II (no sale) would eliminate those impacts described in the proposal. The cancellation of proposed sale 70 could pose potentially adverse impacts on the national economy by continuing dependence on imported oil and gas. Impacts could occur as a result of development of alternative energy sources. Refer to the FEIS for the proposed 5-year oil and gas lease sale schedule, the FEIS for OCS sale 55, Eastern Gulf of Alaska (DOI, 1980), and Appendix H for a general discussion of the potential impacts that could result from various alternative energy sources.

Alternative III (delay the sale) would delay potential impacts of the proposal, but would not avoid them. A reduction in biological and social impacts by some unquantifiable degree could be achieved if the delay were used to strategically plan for community impacts on the St. George Basin area and to fill biological data gaps, especially with regard to fish, birds, and marine mammals. These studies could help to better understand potential impacts on the biological resources of the southern Bering Sea and could provide more information so that potential impacts could be more effectively mitigated. The additional time could also allow for completion of a Coastal Zone Management Plan for the region.

Alternative IV would delete 73 blocks nearest the Pribilof Islands. The alternative reduces the likelihood of oil and gas industrial activities on the Pribilof Islands, thus reducing potential impacts on human and biological resources of this area. This deletion affords minor protection from oilspills reaching the Pribilofs, and the blue king and Korean horsehair crabs inhabiting, spawning, and rearing in these areas. The alternative would reduce the probability of interaction of spilled oil and fisheries resources located in the nearshore areas of the Pribilof Islands from unlikely to very unlikely. Probability of oilspill contact and potential interaction with birds and mammals is similar to the proposal except in the Pribilof Islands vicinity where probabilities are reduced at St. George from 50 to 32 percent and at St. Paul from 15 to 5 percent. This alternative would also eliminate potential spill source points which entail a 47 percent chance that spills would move toward nearshore environments of the Pribilof Islands. A small number of gray whales which summer near the Pribilofs and gray whales migrating south from the northern Bering Sea may be afforded a limited amount of reduced risks of interaction with oilspills as compared to the proposal. The impacts on the social and cultural aspects of the region would be substantially the same as the proposal. The demand for housing and infrastructure in St. Paul could be 10 to 15 percent lower than those of the proposal. With regards to cultural resources, this alternative removes an area of relatively high probability of prior human habitation and would, as a result, lessen the chance of interaction between OCS activity and marine archaeological sites. There would be fewer impacts to onshore cultural resources on the Pribilof Islands. Overall employment impacts in the Aleutian Islands Census Division resulting from the south side of the Alaska Peninsula scenario and Alternative IV would be roughly 85 percent as great as indicated in the proposal. In terms of effects on the entire census division, the probability is very likely that this development will have a significant impact in increasing the total number of jobs. Because infrastructure and employeemnt requirements would be less for this alternative, marine and aircraft traffic impacts would be moderately lower than those described for the proposed action (10-20% reduction). The probability of significant impact would still be very likely. Impacts to potential district Coastal Management Programs would be the same as identified from the proposal, except that impacts to the Pribilof Islands could be less due to a greater distance from the lease area.

Alternative V would delete the southernmost 135 blocks from the proposal, the blocks located nearest the Unimak Pass. Walleye pollock eggs/larvae and larval tanner crab are seasonally widely distributed through the pelagic zone of the waters encompassed by this alternative. The chance of these species being contacted by an oilspill within 3 days after its occurrence is reduced from the proposal's 93 percent to 59 percent. This would be a significant reduction in risk, but pollock egg/larvae are widely distributed over much of the eastern Bering Sea and larval tanner crab are at or near the surface for just a few days after hatching. Some reduction in gear loss, reduced probability of vessel collisions, and reduced risk of oil polluting crab catches would result with this alternative. Oilspill contact and potential interaction with birds is similar to the proposal except in important foraging areas in the vicinity of Unimak Pass and Izembek Lagoon, where it is reduced from likely to very unlikely. The potential for oilspill interaction with marine mammals in important foraging, migration, and breeding areas in the vicinity of Unimak Pass and Izembek Lagoon is reduced from likely to very unlikely. Regionally, significant impacts with seabirds and marine mammals would be unlikely. This alternative would delete blocks which pose a moderate to very high oilspill risk to endangered species migration corridors in the Unimak Pass and northern Unimak Island areas. The probability of significant impact would be very unlikely for cetaceans. Total OCS-induced human population contributed by this alternative would be approximately half the amount produced by the proposal. Impacts of such population should be the same as the proposal in Unalaska and on the Pribilof Islands. Significant population and sociocultural systems impacts could accrue in Cold Bay, where OCS-induced population would still present the long-term prospect of comprising 30 to 40 percent of total population. The likelihood of significant impacts on subsistence persists solely for the Pribilof Islands and is absent elsewhere. Impacts on fishing village livelihood are as unlikely as in the proposal. Impacts on community infrastructure may be decreased by half for St. Paul, Unalaska, and Cold Bay from the proposal. Probability of significant interaction would be very unlikely. Blocks with a high probability of historic shipwrecks are deleted by this alternative, thus lowering the probability of significant impacts to cultural resources from likely to unlikely. Employment levels would be approximately 55 percent that of Alternative I, but there still would be a significant increase in total jobs in the census division. Transportation system impacts resulting from this alternative would be substantially lower than those forecast for the proposed action. They are: a 25-percent reduction in workforce and commuter air traffic; a 40-percent reduction in overall barge traffic; 30- to 35-percent reduction in tanker traffic throughout the life of the field. The probability of significant impacts to transportation would still be very likely. Impacts to potential district Coastal Management Programs for the Aleutian Islands and Alaska Peninsula northeast of Unimak Pass could be diluted due to the greater distance from the proposed sale area.

Alternative VI would delete the 208 blocks comprising a combination of the northern and southern block deletions (Alternative IV and V). This alternative would reduce the probability of interaction of oilspills and fisheries resources located in the nearshore area of the Pribilof Islands from unlikely to very unlikely. The principal species of this resource are blue king and Korean horsehair crabs. Egg and larval forms of walleye pollock and tanner crab are found in the area of the deleted southern blocks, but both species are widely distributed over much of the eastern Bering Sea during these life stages and the probability of significant portions of their populations contacting an oilspill is very unlikely. Commercial fishing would have fewer impacts from this alternative in that oilspills, gear loss and/or damage, and vessel collision risk would be reduced. These reductions are insignificant as probability of significant impact is already assessed as unlikely. Overall probability of oilspill contact and potential interaction with birds is reduced from likely to unlikely in the Pribilof Island area and Unimak Pass/eastern Aleutian area. These two regions are important areas for foraging, migrating, and overwintering seabirds. Oilspill contact and potential interaction with marine mammals is reduced from likely to unlikely in two of the most important areas for foraging and migrating fur seals as well as sea lions, the Pribilof Islands and Unimak Pass/eastern Aleutians. The risk of significant oilspill impacts to seabirds and marine mammals would be unlikely. Disturbance from transportation activity and human presence also would be decreased with this alternative. Deletion of blocks near the Pribilof Islands and Unimak Pass would eliminate potential spill source points which pose relatively high risks to endangered species habitats near the Pribilofs and Unimak Pass. Chance of spills contacting offshore areas north of Unimak Pass is reduced from 7 - 41 percent to 0 - 7 percent. Therefore, significant impacts on such species would be very unlikely. Impacts of such population should be the same as the proposal in Unalaska and on the Pribilof Islands. Significant population and sociocultural systems impacts could accrue in Cold Bay, where OCS-induced population would still present the long-term prospect of comprising 30 to 40 percent of total population. The likelihood of significant impacts on subsistence persists solely for the Pribilof Islands and is absent elsewhere. Impacts on fishing village livelihood are as unlikely as in the proposal. Impacts on infrastructure in St. Paul, Unalaska, and Cold Bay may be decreased by half from those described for the proposal and would be very unlikely to be significant. The alternative would delete blocks which have high probability of prior human habitation and historic shipwrecks. The overall probability of significant impacts to cultural resources would be decreased from likely to very unlikely. Employment impacts in the Aleutian Islands Census Division from this alternative would be about 45 percent as great as indicated for the proposal, but still would represent a significant increase in census division jobs. This action would lessen impacts on the transportation systems by lowering the estimated tanker movements to 40 percent of the proposal, reducing overall barge traffic entering Unalaska during development to half of that forecast for the proposal, and reducing workforce requirements and, hence, enplanement requirements by at least 25 percent. However, stress on air and, to a lesser degree, marine facilities would remain at rather high levels. Significant impacts to transportation systems would still be likely. Impacts to potential district Coastal Management Programs for the Pribilof Islands and the Aleutian Islands could be diluted due to the greater distance away from the proposed sale area.

For a summary of the impacts of other transportation scenarios that could be used see Section IV.B.7., IV.E.7., IV.F.7. and IV.G.7.

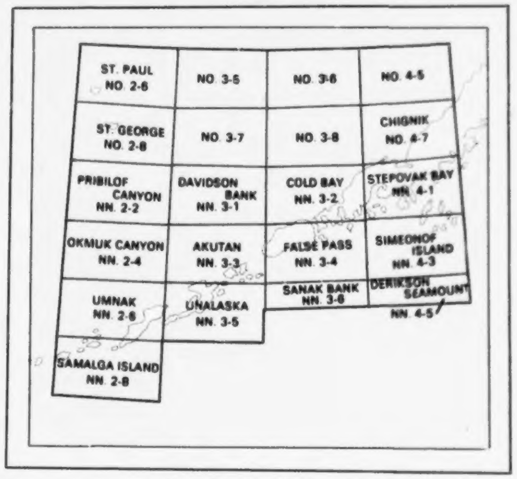
For a summary of the effectiveness of various mitigating measures which may be developed see Section II.B.1.c. as well as individual impact assessment sections in Chapter IV.

BEST DOCUMENT AVAILABLE

Alaska Outer Continental Shelf Office

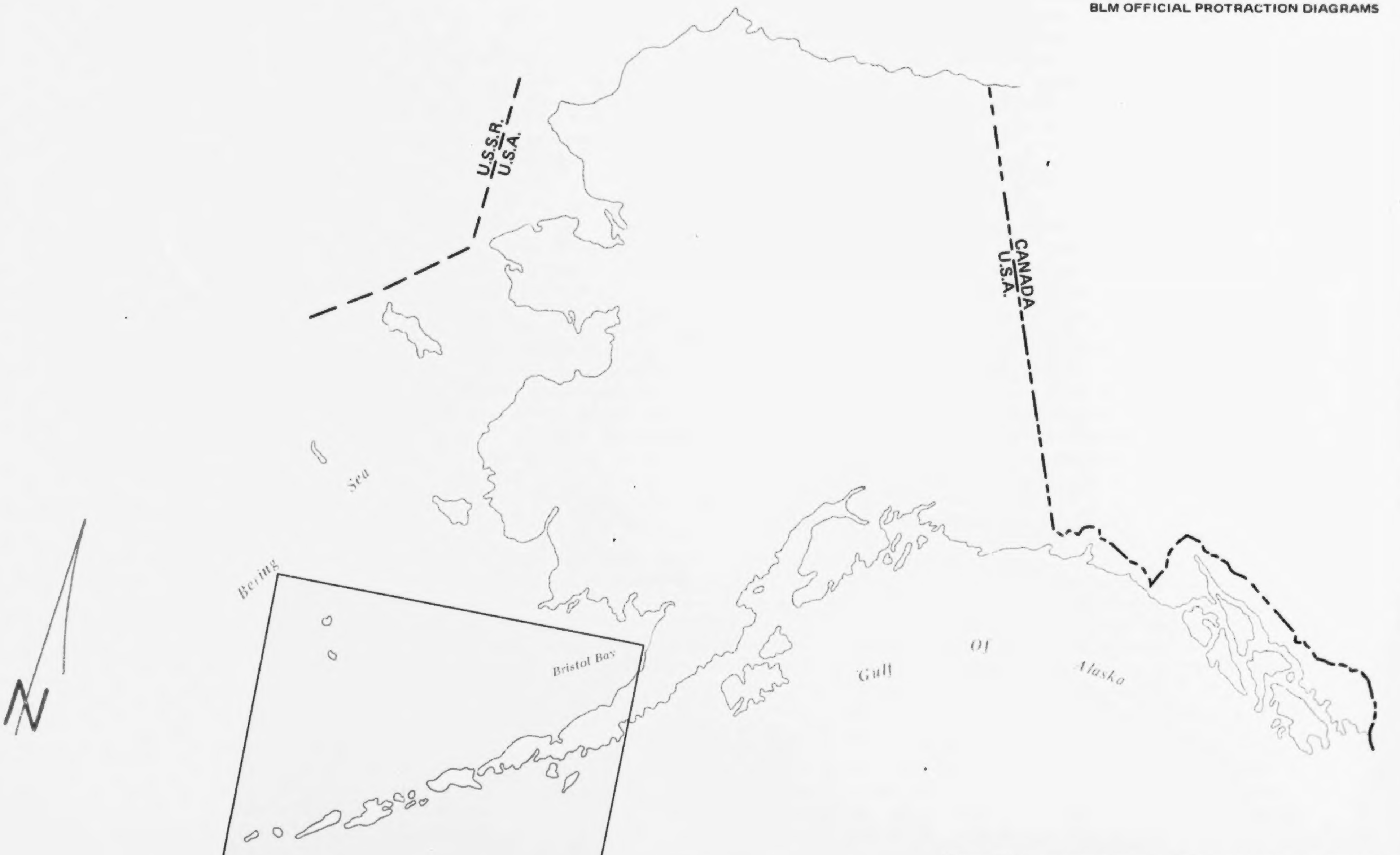
ST. GEORGE BASIN
Proposed Oil & Gas Lease Sale 70

GRAPHIC INDEX MAP



ST. PAUL NO. 2-6
NO. 3-5
NO. 3-6
NO. 4-5
ST. GEORGE NO. 2-8
NO. 3-7
NO. 3-8
CHIGNIK NO. 4-7
PRIBILOF CANYON NN. 2-2
DAVIDSON BANK NN. 3-1
COLD BAY NN. 3-2
STEPOVAK BAY NN. 4-1
OKMUK CANYON NN. 2-4
AKUTAN NN. 3-3
FALSE PASS NN. 3-4
SIMEONOF ISLAND NN. 4-3
UMNAK NN. 2-6
UNALASKA NN. 3-5
SANAK BANK NN. 3-6
DERIKSON SEAMOUNT NN. 4-5
SAMALGA ISLAND NN. 2-8

COVERAGE DIAGRAM FOR
BLM OFFICIAL PROTRACTION DIAGRAMS



U.S.S.R.
U.S.A.
CANADA
U.S.A.
Bering Sea
Bristol Bay
Gulf Of Alaska
N

NOTE: FOR THE CONVENIENCE OF THE READER, ALL FOLD-OUT GRAPHICS MAY BE EASILY CUT OR TORN FROM THE BINDING TO AFFORD MAXIMUM USAGE.

I.

PURPOSE FOR ACTION

I. PURPOSE FOR ACTION

The Federal Government is required by law to manage the exploration and development of oil and gas resources on the Outer Continental Shelf (OCS). To help meet the energy needs of the nation in an environmentally safe manner, these resources must be developed as rapidly and yet as carefully as possible. While overseeing this development, the Federal Government must balance orderly resource development with protection of the human, marine, and coastal environments, ensure that the public receive a fair return for these resources, and preserve and maintain free enterprise competition.

In view of the growing imbalance between domestic oil and gas production and use, especially the expected decline in production from prime areas such as the Gulf of Mexico and the North Slope, there is a greater need to develop resources from the OCS frontier areas.

In compliance with the Outer Continental Shelf Lands Act, as amended, the Secretary of the Interior, prior to approval submits a proposed 5-year leasing program to the Congress, the Attorney General, and the governors of affected states. The Secretary further reviews, periodically revises as necessary, and maintains the oil and gas leasing program. Goals of the leasing program include the orderly development of OCS oil and gas resources in an environmentally acceptable manner and to maintain an adequate contribution of OCS production to the national supply in order to reduce dependence on foreign oil.

Full development of OCS resources is an integral part of the National Energy Plan (Executive Office of the President, Energy Policy and Planning, 1977). The United States has three overriding energy objectives outlined in that plan:

> As an immediate objective that will become even more important in the future, reduce dependence on foreign oil and vulnerability to supply interruptions;
>
> In the medium-term, keep U.S. imports sufficiently low to weather the period when world oil production approaches its capacity limitation; and
>
> In the long-term, have renewable and essentially inexhaustible sources of energy for sustained economic growth.

The DEIS on the proposed 5-year OCS oil and gas lease schedule was released in August 1979. Public hearings were held in Anchorage in October 1979 and the FEIS was published in January 1980. The final 5-year schedule, which runs through May 1985, was approved by the Secretary in June 1980 (Fig. I.-1). In April of 1981, the succeeding Secretary, concerned over the pace at which OCS exploration has been proceeding, began re-examination of the 5-year schedule and prepared a supplemental environmental impact statement and a proposed revised program schedule for the period 1982 through 1986 (Fig. I.-2). Public hearings regarding this revised leasing schedule were held in July 1981. The June 1980 leasing schedule will remain in effect pending completion of the NEPA process and decision on the revised schedule.

Figure I. - 1

FINAL 5-YEAR OCS OIL & GAS LEASING SCHEDULE

PROPOSED SALE AREA	PROPOSED DATE	1980											
		J	F	M	A	M	J	J	A	S	O	N	D
A62 Gulf of Mexico	9/80		F			P	^S_c	R	N	S			
55 Gulf of Alaska	10/80			F		P		^S_c	R	N	S		
62 Gulf of Mexico	11/80		F				P		^S_c	R	N	S	
53 Central N. Calif.	5/81				E		H			F	P		
RS-1 Reoffering Sale	6/81												
A66 Gulf of Mexico	7/81							E		H			F
56 South Atlantic	8/81							E		H			
60 Cook Inlet	9/81								E		H		
66 Gulf of Mexico	10/81							E		H			F
59 Mid-Atlantic	12/81											E	
67 Gulf of Mexico	3/82	C		D		T							
RS-2 Reoffering Sale	6/82												
68 Southern California	6/82		D			T							
69 Gulf of Mexico	8/82	C		D		T							
57 Norton Basin	9/82		T										
52 North Atlantic	10/82		D				T						
70 St. George Basin	12/82		T										
71 Beaufort Sea	2/83			T									
72 Gulf of Mexico	3/83												
61 Kodiak	4/83									C		D	
73 California	5/83											C	
RS-3 Reoffering Sale	6/83												
74 Gulf of Mexico	9/83												
75 No. Aleutian Shelf	10/83					C			D				T
76 Mid-Atlantic	11/83												
78 So. Atlantic	1/84												
79 Gulf of Mexico	3/84												
RS-4 Reoffering Sale	5/84												
80 California	6/84												
81 Gulf of Mexico	7/84												
82 North Atlantic	10/84												
83 Navarin Basin	12/84												
84 Gulf of Mexico	1/85												
☆ 85 Chukchi Sea	2/85												
86 Hope Basin	5/85												
RS-5 Reoffering Sale	6/85												

PROPOSED SALE AREA	PROPOSED DATE	1981											
		J	F	M	A	M	J	J	A	S	O	N	D
A62 Gulf of Mexico	9/80												
55 Gulf of Alaska	10/80												
62 Gulf of Mexico	11/80												
53 Central N. Calif.	5/81		^S_c	R	N	S							
RS-1 Reoffering Sale	6/81	P		^S_c	R	N	S						
A66 Gulf of Mexico	7/81		P		^S_c	R	N	S					
56 South Atlantic	8/81	F		P		^S_c	R	N	S				
60 Cook Inlet	9/81		F		P		^S_c	R	N	S			
66 Gulf of Mexico	10/81					P		^S_c	R	N	S		
59 Mid-Atlantic	12/81	H				F		P		^S_c	R	N	S
67 Gulf of Mexico	3/82			E		H			F		P		^S_c
RS-2 Reoffering Sale	6/82												
68 Southern California	6/82					E		H				F	
69 Gulf of Mexico	8/82			E		H			F				
57 Norton Basin	9/82						E				H		
52 North Atlantic	10/82									E		H	
70 St. George Basin	12/82										E		
71 Beaufort Sea	2/83												E
72 Gulf of Mexico	3/83	C		D		T							
61 Kodiak	4/83		T										
73 California	5/83	D			T								
RS-3 Reoffering Sale	6/83												
74 Gulf of Mexico	9/83	C		D		T							
75 No. Aleutian Shelf	10/83												
76 Mid-Atlantic	11/83					C		D			T		
78 So. Atlantic	1/84			C			D				T		
79 Gulf of Mexico	3/84												
RS-4 Reoffering Sale	5/84												
80 California	6/84										C		D
81 Gulf of Mexico	7/84												
82 North Atlantic	10/84												
83 Navarin Basin	12/84						C			D			
84 Gulf of Mexico	1/85												
☆ 85 Chukchi Sea	2/85							C			D		
86 Hope Basin	5/85									C			D
RS-5 Reoffering Sale	6/85												

PROPOSED SALE AREA	PROPOSED DATE	1982											
		J	F	M	A	M	J	J	A	S	O	N	D
A62 Gulf of Mexico	9/80												
55 Gulf of Alaska	10/80												
62 Gulf of Mexico	11/80												
53 Central N. Calif.	5/81												
RS-1 Reoffering Sale	6/81												
A66 Gulf of Mexico	7/81												
56 South Atlantic	8/81												
60 Cook Inlet	9/81												
66 Gulf of Mexico	10/81												
59 Mid-Atlantic	12/81												
67 Gulf of Mexico	3/82	R	N	S									
RS-2 Reoffering Sale	6/82		P		^S_T	N	S						
68 Southern California	6/82	P		^S_c	R	N	S						
69 Gulf of Mexico	8/82			P		^S_c	R	N	S				
57 Norton Basin	9/82		F		P		^S_c	R	N	S			
52 North Atlantic	10/82			F		P		^S_c	R	N	S		
70 St. George Basin	12/82	H				F		P		^S_c	R	N	S
71 Beaufort Sea	2/83			H				F		P		^S_c	R
72 Gulf of Mexico	3/83			E		H			F		P		^S_c
61 Kodiak	4/83			E			H			F		P	
73 California	5/83				E		H				F		P
RS-3 Reoffering Sale	6/83												
74 Gulf of Mexico	9/83			E		H			F				
75 No. Aleutian Shelf	10/83								E			H	
76 Mid-Atlantic	11/83										E		H
78 So. Atlantic	1/84											E	
79 Gulf of Mexico	3/84	C		D		T							
RS-4 Reoffering Sale	5/84												
80 California	6/84	T											
81 Gulf of Mexico	7/84	C		D		T							
82 North Atlantic	10/84				C		D			T			
83 Navarin Basin	12/84	T											
84 Gulf of Mexico	1/85											C	
☆ 85 Chukchi Sea	2/85		T										
86 Hope Basin	5/85				T								
RS-5 Reoffering Sale	6/85												

PROPOSED SALE AREA	PROPOSED DATE	1983											
		J	F	M	A	M	J	J	A	S	O	N	D
A62 Gulf of Mexico	9/80												
55 Gulf of Alaska	10/80												
62 Gulf of Mexico	11/80												
53 Central N. Calif.	5/81												
RS-1 Reoffering Sale	6/81												
A66 Gulf of Mexico	7/81												
56 South Atlantic	8/81												
60 Cook Inlet	9/81												
66 Gulf of Mexico	10/81												
59 Mid-Atlantic	12/81												
67 Gulf of Mexico	3/82												
RS-2 Reoffering Sale	6/82												
68 Southern California	6/82												
69 Gulf of Mexico	8/82												
57 Norton Basin	9/82												
52 North Atlantic	10/82												
70 St. George Basin	12/82												
71 Beaufort Sea	2/83	N	S										
72 Gulf of Mexico	3/83	R	N	S									
61 Kodiak	4/83	^S_c	R	N	S								
73 California	5/83		^S_c	R	N	S							
RS-3 Reoffering Sale	6/83		P		^S_T	N	S						
74 Gulf of Mexico	9/83				P		^S_c	R	N	S			
75 No. Aleutian Shelf	10/83			F		P		^S_c	R	N	S		
76 Mid-Atlantic	11/83				F		P		^S_c	R	N	S	
78 So. Atlantic	1/84		H				F		P		^S_c	R	N
79 Gulf of Mexico	3/84			E		H			F		P		^S_c
RS-4 Reoffering Sale	5/84												
80 California	6/84					E		H				F	
81 Gulf of Mexico	7/84			E		H			F				
82 North Atlantic	10/84									E		H	
83 Navarin Basin	12/84										E		
84 Gulf of Mexico	1/85	D		T									
☆ 85 Chukchi Sea	2/85												E
86 Hope Basin	5/85												
RS-5 Reoffering Sale	6/85												

PROPOSED SALE AREA	PROPOSED DATE	1984											
		J	F	M	A	M	J	J	A	S	O	N	D
A62 Gulf of Mexico	9/80												
55 Gulf of Alaska	10/80												
62 Gulf of Mexico	11/80												
53 Central N. Calif.	5/81												
RS-1 Reoffering Sale	6/81												
A66 Gulf of Mexico	7/81												
56 South Atlantic	8/81												
60 Cook Inlet	9/81												
66 Gulf of Mexico	10/81												
59 Mid-Atlantic	12/81												
67 Gulf of Mexico	3/82												
RS-2 Reoffering Sale	6/82												
68 Southern California	6/82												
69 Gulf of Mexico	8/82												
57 Norton Basin	9/82												
52 North Atlantic	10/82												
70 St. George Basin	12/82												
71 Beaufort Sea	2/83												
72 Gulf of Mexico	3/83												
61 Kodiak	4/83												
73 California	5/83												
RS-3 Reoffering Sale	6/83												
74 Gulf of Mexico	9/83												
75 No. Aleutian Shelf	10/83												
76 Mid-Atlantic	11/83												
78 So. Atlantic	1/84	S											
79 Gulf of Mexico	3/84	R	N	S									
RS-4 Reoffering Sale	5/84	P		^S_T	N	S							
80 California	6/84	P		^S_c	R	N	S						
81 Gulf of Mexico	7/84		P		^S_c	R	N	S					
82 North Atlantic	10/84			F		P		^S_c	R	N	S		
83 Navarin Basin	12/84	H				F		P		^S_c	R	N	S
84 Gulf of Mexico	1/85	E		H			F		P		^S_c	R	N
☆ 85 Chukchi Sea	2/85			H				F		P		^S_c	R
86 Hope Basin	5/85			E			H				F		P
RS-5 Reoffering Sale	6/85												

PROPOSED SALE AREA	PROPOSED DATE	1985											
		J	F	M	A	M	J	J	A	S	O	N	D
A62 Gulf of Mexico	9/80												
55 Gulf of Alaska	10/80												
62 Gulf of Mexico	11/80												
53 Central N. Calif.	5/81												
RS-1 Reoffering Sale	6/81												
A66 Gulf of Mexico	7/81												
56 South Atlantic	8/81												
60 Cook Inlet	9/81												
66 Gulf of Mexico	10/81												
59 Mid-Atlantic	12/81												
67 Gulf of Mexico	3/82												
RS-2 Reoffering Sale	6/82												
68 Southern California	6/82												
69 Gulf of Mexico	8/82												
57 Norton Basin	9/82												
52 North Atlantic	10/82												
70 St. George Basin	12/82												
71 Beaufort Sea	2/83												
72 Gulf of Mexico	3/83												
61 Kodiak	4/83												
73 California	5/83												
RS-3 Reoffering Sale	6/83												
74 Gulf of Mexico	9/83												
75 No. Aleutian Shelf	10/83												
76 Mid-Atlantic	11/83												
78 So. Atlantic	1/84												
79 Gulf of Mexico	3/84												
RS-4 Reoffering Sale	5/84												
80 California	6/84												
81 Gulf of Mexico	7/84												
82 North Atlantic	10/84												
83 Navarin Basin	12/84												
84 Gulf of Mexico	1/85	S											
☆ 85 Chukchi Sea	2/85	N	S										
86 Hope Basin	5/85		^S_c	R	N	S							
RS-5 Reoffering Sale	6/85		P		^S_T	N	S						

March 3 1849

Cecil D. Andrus
Secretary of the Interior

C - Call For Nominations
D - Nominations Due
T - Tentative Tract Selection
E - Draft Environmental Statement

H - Public Hearing
F - Final Environmental Statement
P - Proposed Notice of Sale
^S_c - State Comments Due

R - Energy Review
N - Notice of Sale
S - Sale

☆ The holding of the Chukchi Sale at this time is contingent upon a reasonable assumption that technology will be available for exploration and development of the tracts included in the sale.

JUNE 1980

Figure I.–2

PROPOSED 5-YEAR OCS OIL AND GAS LEASING SCHEDULE

PROPOSED SALE AREA	SALE DATE	1981												1982											
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
60 LOWER COOK/ SHELIKOF STRAIT	9/81		F		P		G	R	N	S															
RS 2	6/82														P		G R	N	S						
71 DIAPIR FIELD	9/82												E		H			F P		G R	N	S			
57 NORTON BASIN	11/82														F					P		G R	N	S	
70 ST. GEORGE BASIN	2/83																H				F		P		G R
75 NO. ALEUTIAN SHELF	4/83																			E		H			F P
83 NAVARIN BASIN	3/84																C	D		A					
87 DIAPIR FIELD	6/84																						C	D	
88 NORTON BASIN	10/84																								
89 ST. GEORGE BASIN	12/84																								
85 BARROW ARCH	2/85																								
92 N. ALEUT BASIN	4/85																								
86 HOPE BASIN	7/85																								
100 S. ALASKA *	10/85																								
107 NAVARIN BASIN	3/86																								
97 DIAPIR FIELD	6/86																								
99 NORTON BASIN	10/86																								
101 ST. GEORGE BASIN	12/86																								

PROPOSED SALE AREA	SALE DATE	1983												1984											
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
60 LOWER COOK/ SHELIKOF STRAIT	9/81																								
RS 2	6/82																								
71 DIAPIR FIELD	9/82																								
57 NORTON BASIN	11/82																								
70 ST. GEORGE BASIN	2/83	N	S																						
75 NO. ALEUTIAN SHELF	4/83		G R	N	S																				
83 NAVARIN BASIN	3/84					E		H				F P		G R	N	S									
87 DIAPIR FIELD	6/84	A								E		H			F P		G R	N	S						
88 NORTON BASIN	10/84		C	D		A								E		H			F P		G R	N	S		
89 ST. GEORGE BASIN	12/84				C	D		A								E		H			F P		G R	N	S
85 BARROW ARCH	2/85						C	D		A								E		H			F P		G R
92 N. ALEUT BASIN	4/85								C	D		A								E		H			F P
86 HOPE BASIN	7/85											C	D		A								E		H
100 S. ALASKA *	10/85														C	D		A							
107 NAVARIN BASIN	3/86																			C	D		A		
97 DIAPIR FIELD	6/86																						C	D	
99 NORTON BASIN	10/86																								
101 ST. GEORGE BASIN	12/86																								

PROPOSED SALE AREA	SALE DATE	1985												1986											
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
60 LOWER COOK/ SHELIKOF STRAIT	9/81																								
RS 2	6/82																								
71 DIAPIR FIELD	9/82																								
57 NORTON BASIN	11/82																								
70 ST. GEORGE BASIN	2/83																								
75 NO. ALEUTIAN SHELF	4/83																								
83 NAVARIN BASIN	3/84																								
87 DIAPIR FIELD	6/84																								
88 NORTON BASIN	10/84																								
89 ST. GEORGE BASIN	12/84																								
85 BARROW ARCH	2/85	N	S																						
92 N. ALEUT BASIN	4/85		G R	N	S																				
86 HOPE BASIN	7/85			F P		G R	N	S																	
100 S. ALASKA *	10/85	E		H			F P		G R	N	S														
107 NAVARIN BASIN	3/86						E		H			F P		G R	N	S									
97 DIAPIR FIELD	6/86	A								E		H			F P		G R	N	S						
99 NORTON BASIN	10/86		C	D		A								E		H			F P		G R	N	S		
101 ST. GEORGE BASIN	12/86				C	D		A								E		H			F P		G R	N	S

C – Call for Information
D – Information Due
A   Area Selection

E – Draft Environmental Impact Statement
H -- Public Hearing
F -- Final Environmental Impact Statement

P – Proposed Notice of Sale
G – Governors' Comments Due
R -- DOE Review

N - Notice of Sale
S – Sale
* Includes Cook Inlet, Shumagin, Kodiak & Gulf of Alaska

Alaska Outer Continental Shelf Office
July 15, 1981

The OCS leasing program does not represent a decision to lease in a particular area. It represents only the Department's intent to consider leasing in certain areas, and to proceed with the leasing of such areas only if it should be determined that leasing and development would be environmentally, technically, and economically acceptable.

As a part of the overall OCS leasing program, proposed sale 70 in the St. George Basin is presently scheduled for December 1982.

A. Leasing Process

The Outer Continental Shelf Lands Act of 1953 (43 U.S.C. 1331-1343) as amended, charges the Secretary of the Interior with administering mineral exploration and development on the outer continental shelf as well as conserving natural resources of the shelf. The law, inter alia, requires that the Secretary of the Interior develop oil and gas in an orderly and timely manner to meet the energy needs of the country, to protect the human, marine, and coastal environments, and to receive a fair and equitable return on the resources of the OCS. The Secretary delegated responsibility for the leasing of submerged Federal lands to the Bureau of Land Management (BLM) (43 CFR 3300) and the responsibility for the supervision and regulation of offshore operations after lease issuance to the U.S. Geological Survey (USGS) (30 CFR 250). BLM works closely with USGS, particularly on technical matters. The leasing process includes the following decisionmaking steps implemented for proposed sales and, where applicable, a specific discussion is included for this proposal.

1. Leasing Schedule: The Outer Continental Shelf Lands Act, as amended, requires the Secretary to develop a 5-year OCS oil and gas leasing program, to be reviewed at least annually. This program must consist of a schedule of proposed lease offerings which the Secretary determines will best meet national energy needs for the 5-year period following its approval. The current schedule, approved in June 1980, covers the period from mid-1980 through mid-1985, and provides for 36 possible lease sales, including five reoffering sales. These sales reoffer rejected-bid or no-bid tracts which were offered for sale in the previous calendar year. The June 1980 schedule proposes ten lease offerings in offshore Alaska. Included is one proposed sale for the St. George Basin in November 1982. In April 1981, the Secretary of the Interior published a draft supplement to the final environmental statement on a proposed revised 5-year leasing schedule (46 FR 22468, 4/17/81). This supplement considers a 5-year schedule consisting of 42 oil and gas lease sales in 17 areas of the OCS in the period between January 1982 and December 1986. The proposed schedule under consideration proposes 16 sales in the Alaska OCS, including 3 sales in the St. George Basin area, scheduled for February 1983, December 1984, and December 1986, respectively. The current approved June 1980 schedule will remain in effect until the Secretary makes his final decisions on the proposed revised program, after public input and completion of the NEPA process. The proposed revised 5-year program was submitted to Congress for approval in July 1981.

2. Request for Resource Reports: Resource reports for a specific lease area are requested from numerous Federal and state agencies, generally from 2½ to 3 years prior to the scheduled lease sale date. These reports provide valuable geological, environmental, biological, oceanographic, naviga-

tional, recreational, archaeological, and socioeconomic information on the leasing area to be offered. They are an important factor in determining the suitability for leasing and the possible need for mitigating measures for certain blocks within the leasing area. Resource reports for proposed lease sale 70 were requested from various Federal and state agencies on June 22, 1979, and were due to the Alaska OCS Office on September 14, 1979.

3. Call for Nominations and Comments: The Call is a request for information and is published in the Federal Register. Responses are requested from oil companies, government agencies, private citizens, environmental groups, and the public concerning which blocks should be included in the lease sale. The Call for proposed sale 70 was published in the Federal Register (44 FR 43818) on July 26, 1979, requesting nominations and comments by October 31, 1979. The Call included 8,200 blocks, covering 18.6 million hectares (45.9 million acres), located in the eastern Bering Sea offshore Dutch Harbor in the Aleutian Island chain. Blocks with potential for oil and gas were identified, as well as areas of significant environmental concern. In response to the Call, 13 comments were submitted and 14 companies nominated 5,900 blocks, approximately 13.2 million hectares (32.6 million acres).

4. Tentative Tract Selection: Using information received from the Resource Reports and Call for Nominations and Comments, together with recommendations from USGS and Fish and Wildlife Service (FWS), state comments, and the Department of the Interior's own environmental, technological, and socioeconomic information, the Secretary selects a tentative list of blocks for further consideration for leasing in an environmental impact statement. The Secretary of Interior announced selection of 479 blocks in the St. George Basin comprising approximately 1.1 million hectares (2.7 million acres) on February 20, 1980.

5. Scoping Meetings: Scoping meetings provide an opportunity for the OCS staff to meet with representatives from other Federal and state agencies, the oil and gas industry, environmental groups, and the public in order to identify critical issues and alternatives to the proposed action. Scoping meetings were conducted in March, April, and May 1980, at central locations in the St. George area. Scoping meetings were held at the Pribilof Islands (St. Paul, St. George) and Dillingham. Additional public meetings were held in Juneau and Anchorage to gather information from state and Federal agencies. Refer to Section I.F. for an additional discussion of the scoping process for proposed sale 70.

6. Preparation of Draft Environmental Impact Statement (DEIS): Preparation of the environmental impact statement (EIS) is required in accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969 (NEPA). As an integral part of the DEIS development, a "synthesis meeting" is held prior to the actual writing of the DEIS. The St. George synthesis meeting was held in Anchorage in April 1981. This BLM-sponsored meeting assembles researchers who are knowledgeable concerning the information available in a specific lease area. Refer to Section III.I. for a description of BLM-sponsored studies.

Included in the DEIS are a description of the marine and onshore environments, a detailed analysis of possible adverse impacts on the environment (including cumulative impacts as a result of other projects in the area), potential mitigating measures, any irreversible or irretrievable commitment of resources, the alternatives to the proposal, and the records of consultation and coordination with others in preparation of the statement. When the availability of the DEIS is announced in the *Federal Register*, the Alaska OCS Office delivers copies of the DEIS to the Office of the Governor--as well as the interested public.

7. *Endangered Species Consultation*: Pursuant to Section 7 of the Endangered Species Act, consultation with appropriate Federal agencies is required when there is reason to believe that a species that is on the list as endangered or threatened (or is proposed to be listed as such) may be affected by a proposed action. A formal consultation meeting between BLM, USGS, FWS, and National Marine Fisheries Service (NMFS) was held to convey information on the exploration phase of proposed Federal lease sales in the Bering Sea, and to obtain biological opinions, as necessary, regarding potential effects of exploratory activities on endangered species. Subsequently, a biological opinion for the exploratory phase was received from the U.S. Fish and Wildlife Service (refer to Sec. IV.B.1.d and Appendix H). Although a biological opinion on probable effects on endangered whales was expected on or before September 23, 1980, an extension of the response period was mutually agreed to by NMFS and BLM. The biological opinion has not been received, but is expected prior to publication of the Final EIS (FEIS). As required under the Endangered Species Act of 1973, as amended, Section 7 consultation will continue, as needed, and as may be related to development and production phases of the proposed sale (see Sec IV.B.1.d. for further information on the status of endangered species consultation).

8. *Public Hearings*: A minimum 45-day review period follows release of the DEIS. Public hearings are held, and specific dates and locations for public hearings announced in the *Federal Register*. Oral and written comments are obtained and incorporated into the FEIS, which is then made available to the public. Public hearings on this DEIS are scheduled for late March or early April 1982.

9. *Secretarial Issue Document (SID)*: Following the preparation of the FEIS, a SID is developed for use by the Secretary of the Interior. The SID brings to the decisionmaker's attention factors associated with the proposed action by presenting the significant issues and identifying the alternative actions. Issues may include environmental and physical factors based upon the EIS as well as potential economic and social impacts of the proposal and its affect on the Department's program. The SID and the FEIS provide the necessary information to the Secretary to make a decision on various sale options, including whether or not to hold a sale, and if so, under what terms and conditions.

10. *Proposed Notice of Sale*: This notice is sent to the governors of any affected states, who then have 60 days to submit comments to the Secretary regarding the size, timing, or location of the proposed lease sale (43 CFR 3315.1).

11. *Decision and Notice of Sale*: After all of the above steps have been taken, the Secretary makes his final decision on whether to hold the sale and, if so, the terms to be included in the final Notice of Sale. The final notice, published in the *Federal Register* at least 30 days before the sale, may be quite different from the preliminary notice; i.e., blocks may be de-

leted, bidding systems may be altered, or stipulations may be added or amended. The final notice is prepared by BLM and reviewed principally by USGS, FWS, and the Department of Energy (DOE).

12. Lease Sale: Sealed industry bids for individual blocks are opened and read at the lease sale. The Secretary reserves the right to withdraw blocks from the proposed sale, as well as reject any bids received. The Secretary has 60 days to accept or reject all bids. Under the current schedule, proposed sale 70 is tentatively scheduled for December 1982. However, a proposed revised schedule (April 1981) would change the sale date to February 1983.

After leases are awarded by BLM, USGS is the administrative agency responsible for supervising and regulating operations conducted on the leasehold. Prior to exploration, the lessee must submit an exploration plan (the Application for Permit to Drill) and environmental report to USGS for approval. BLM, FWS, and the State of Alaska are provided an opportunity to comment on this plan.

B. Leasing History

There has been no Federal OCS leasing in the St. George Basin. Petroleum industry interest in this area has been strong. Refer to paragraphs 3 (Call for Nominations) and 4 (Tentative Tract Selection) in the preceding section (I.A.) for specific information regarding the leasing process for the St. George Basin. In 1976, one Continental Offshore Strategraphic Test (COST) well was drilled in the St. George Basin area by the Atlantic Richfield Company. One additional COST well has been proposed to be drilled in this area during the spring of 1982.

C. Legal Mandates and Authority

The description of legal mandates and authority for OCS leasing is contained in BLM-Alaska OCS Technical Paper No. 4, Legal Mandates and Federal Regulatory Responsibilities (Casey, 1981). One of the more important discussions in the paper is an explanation of the Secretary's Authorities on the OCS. The technical paper also contains the following:

Summary of the OCS Lands Act, as amended, including a detailed discussion of the requirements for Federal/state coordination, establishment of compensatory funds, and the environmental studies program.

Discussion of responsibilities of other Federal agencies with respect to OCS.

A discussion of the Secretary's authority to suspend operations and cancel a lease for environmental reasons.

The functions of the National OCS Advisory Board and the Intergovernmental Planning Program (IPP). (The IPP primarily serves an advisory function on technical matters of the OCS program.)

OCS Operating Orders, prepared by USGS, for the Arctic and Gulf of Alaska areas.

D. Federal Regulatory Responsibilities

Federal regulatory responsibilities that affect the OCS leasing program are contained in BLM-Alaska OCS Technical Paper No. 4, Legal Mandates and Federal Regulatory Responsibilities (Casey, 1981). Responsibilities of the Departments of Interior, Transportation, Commerce, and Energy are described, as well as those for the U.S. Army Corps of Engineers, the Environmental Protection Agency, and the Interstate Commerce Commission.

E. Results of the Scoping Process

The proposed lease sale 70 scoping process consisted of a Request for Resource Reports on June 22, 1980, call for nominations and comments, as well as meetings held during 1980-1981 at central locations on the Aleutian and Pribilof Islands and the urban areas of Anchorage and Juneau. (Refer to Section V., Consultation and Coordination, for a detailed discussions of the scoping process for proposed lease sale 70.)

Results of the scoping meetings and the issues raised in written comments were analyzed and the following major issues were identified:

Major Issues	Concerns
Fishing Conflict: (commercial fishing)	Effects of oil exploration and development activity on salmon, crab, herring, bottomfish, and international fisheries.
Fur Seal Conflict:	Loss of seal harvest without replacement of equivalent incomes.
Oilspills:	Lack of cleanup technology for a spill on or under the ice. Slow response time to oil cleanup.
Fishing Gear Conflict:	Oilspill contingency planning, dragging doors over pipelines, damage to crab pots and fish nets from seismic, and support and supply vessels.
Marine Mammals: (other than fur seal)	Migration routes of marine mammals. Effects of oil exploration and development on marine mammal behavior.
Local Hire:	Will local people get work in the oil industry? Will local people be trained?
Weather:	Severity of winter conditions and the inability of industry to safely conduct activities. Adequacy of data on winds, waves, and current systems.
Local Economy and Transportation:	Increase in prices of food, hardware, and fuel. Local people and tourists will get pushed out of air and water transportation in favor of criti-

	cal supplies to the oil industry. Boom and bust syndrome at Unalaska. Lack of housing for incoming people.
Cultural Resources:	Impact of population on cultural resources.
Increase in Violence and Mental Illness:	Lack of facilities to handle offenders. Lack of medical facilities to provide adequate patient care for both mental and medical illness.
Endangered Bird Populations:	Particularly Izembek Lagoon and the Pribilof Islands.
Unimak Pass:	Concern for heavy oil traffic and migration of mammals in Unimak Pass. Concern about traffic lanes in Unimak Pass when tankers begin moving through there. Cumulative impacts from more southern sales in the area, especially Unimak Pass.

The following were suggested during the scoping process as mitigating measures that should be considered in the environmental impact statement:

An orientation program for petroleum industry personnel.

Pipeline burial below the bottom silt.

Designation of fairways for vessel traffic.

Cultural resources stipulation.

The above measures are addressed in Section II.B.1.c., Discussion of Potential Mitigating Measures for the Proposal. Block deletion alternatives discussed during the scoping process were analyzed and are included in this environmental impact statement. They are as follows:

The Pribilof Deletion, Alternative IV. (Fig. II.B.4.-1)

The Unimak Pass Deletion, Alternative V. (Fig. II.B.5.-1)

The Pribilof and Unimak Pass Deletion, Alternative VI. (Fig. II.B.6.-1)

II.

ALTERNATIVES INCLUDING THE PROPOSED ACTION

II. ALTERNATIVES INCLUDING THE PROPOSED ACTION

This section describes the proposed action and each alternative to the proposal. It also outlines the various production assumptions, development scenarios, resource estimates, and mitigating measures which shape the environmental analysis contained within this document. Finally, this section includes a summary of probable impacts of the proposed action and each of its alternatives. Refer to Section IV for more detailed analysis of probable impacts.

A. Resource Estimates and Production Assumptions

The resource estimates used in this EIS assume that favorable geologic conditions exist so that oil and gas are present and are contained in traps within the proposed lease area in commercial quantities. However, the USGS has estimated that there is a 72 percent chance that no commercial oil, and a 63 percent chance that no commercial gas resources, will be discovered within the proposed sale area. Conversely, there is a 28 percent chance and a 37 percent chance for discovery of commercial oil and gas, respectively. This degree of risk is applicable to all alternatives discussed within this EIS. The risk factor is subject to modification as more is learned about the area. Any citation of this unrisked resource data should clearly state that the information assumes discovery. Estimates of resource potential are speculative, particularly in areas such as the St. George Basin where geologic information is limited and the presence of oil and gas has not been demonstrated.

The method used to develop the resource estimates by the USGS involved an analysis of geophysical and geologic information on subsurface and adjacent surface formations. This information became the input to engineering and economic calculations to determine minimum commercial field sizes. These minimum field sizes, plus the hydrocarbon structure information were statistically blended in a model using a Monte Carlo (random) technique to produce the proposed lease area's commercial resource distribution curve. Then, assuming that commercial resources were found, the minimum case, the mean case, and the maximum case were then rerun using a Monte Carlo technique to determine production factors such as number of wells and reservoir decline patterns.

The resource estimates are based on primary production. Improvement of drilling technology and exploration science could lead to an increase in the estimate of recoverable resources. Differing assumptions regarding exploration and development costs, operating expenses, the price and market for oil and natural gas, taxes, depreciation, and royalty and production rates would affect the estimates of the recoverable resources. Similarly, a significant change in one or several of these factors in the future could affect the amount of resources actually recovered.

Table II.A.-1 is a comparison of resource estimates by the Geological Survey for the maximum, mean, and minimum levels for recoverable oil and natural gas within the proposed lease area. The indicated resources are based upon unrisked (assuming discovery) statistical resource estimates.

The environmental analysis for each alternative is based on the assumption that resource development would result in the production estimates shown in Table II.A.-1.

Table II.A.-1
Resource Comparison of the Proposal and Each of its Alternatives

	Minimum Case[1]	Mean Case Alternative I (Proposal)	Maximum Case[2]	Alternative IV	Alternative V	Alternative VI
Oil[3]	0.24	1.12	3.04	1.00	0.59	0.47
Gas[4]	1.48	3.66	8.80	2.55	2.46	1.90

1/Assuming the discovery of commercial amounts of hydrocarbons, the minimum case reflects the amount of hydrocarbons which could be found in the sale area based on a 95-percent statistical probability. In other words, if hydrocarbons are located within the sale area, there is a 95-percent chance that they will be equal to 0.24 Bbbls of oil and 1.48 tcf of natural gas. These resources are based on unrisked resource estimates (assuming discovery).

2/The maximum case reflects the amount of hydrocarbons which could be found in the sale area on a 5-percent statistical probability.

3/In billions of barrels.

4/In trillions of cubic feet.

Source: USGS, October 17, 1980 memo.

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Alternative I is the mean resource level of the proposed action. Alternative II is the no sale case. Alternative III portrays a situation in which the sale of the blocks under study is delayed 2 years. Resource estimates indicated for Alternatives IV, V, and VI are all variations of the mean level resource estimate.

The following discussion focuses on the developmental and transportation scenarios upon which the environmental analysis contained herein is based. A primary or favored infrastructure/transportation scenario has not been selected, but rather a range of options are introduced. Among the wide range of developmental scenarios which could be used to develop the estimated resources, four have been chosen which should typify the options available to the oil and gas industry. One scenario hypothesizes processing and terminal facilities on a bay located on the southern shore of the Alaska Peninsula; the second hypothesizes construction of one or more processing and loading facilities at St. Paul Island; the third hypothesizes construction of onshore facilities near Makushin Bay (Unalaska Island); and the fourth hypothesizes the offshore processing and loading of all produced hydrocarbons. These are only examples of the types of transportation facilities which may be needed and possible general areas around the lease sale area which may be utilized.

One of these four scenarios was selected to assess impacts for the proposal and alternatives. The developmental scenario used locates a terminal facility on the south side of the Alaska Peninsula. By selecting one common scenario for all alternatives, the reader can differentiate between alternatives. The effect of different scenarios within each alternative is also addressed in this document. The Secretary, in his decision to hold a sale in the St. George Basin, will not be prescribing a specific transportation scenario. The eventual development scenario will be dependent upon the presence of a commercial quantity of oil and gas, size of field, economics, and many other factors. The selection of a specific scenario cannot be made at this time, nor is it a decision of the Secretary.

Two of the three shore facility options are generally ice-free, and VLCC class oil tankers could use these ports in all seasons without the assistance of ice-breaking tugs. However, if the terminal were at St. Paul, ice conditions in some years could force the use of ice-breaking tankers and possibly cause a short-term slowdown in hydrocarbon transport.

Pipeline lengths to each of these locations vary but the longest by far would be a pipeline constructed to the Makushin Bay area. Straight-line distances from Makushin Bay to a point in the center of the proposed sale area compare favorably with other indicated sites. However, due to the depth of the Bering Canyon and the unstable sediments on its slopes (see Sec. III.A.1.), a Makushin Bay pipeline would require extensive rerouting.

The exploratory, developmental, and production infrastructure scenarios for each alternative will be discussed under the appropriate headings in Sections II and IV.

The infrastructure scenarios represent a compilation based on discussions of the Alaska OCS Office with U.S. Geological Survey, the consulting firm of Dames and Moore, and the Atlantic Richfield Company. The scenario discussed within this document, as well as the physical description of the alternatives

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and their resource estimates, receive expanded treatment in Alaska OCS Technical Paper No. 1, Resources, Developmental Timeframes, Infrastructure Assumptions and Block Deletion Alternatives for Proposed Federal Lease Sales in the Bering Sea and Norton Sound (Tremont, 1981).

Because of the many assumptions involved, this analysis is not intended, nor should it be used as, "a local planning document" by potentially affected communities, nor is it a forecast or prediction of the future. It is simply a best estimate of reasonably possible events. All facility locations and scenarios described in this EIS are intended to represent only a few likely locations and scenarios. They serve only as a basis for identifying characteristic activities and resulting impacts for this EIS and do not represent a BLM recommendation, preference, or endorsement of facility sites or development schemes. Local control of events may be accomplished through planning, zoning, and land ownership, as well as other state and local laws and regulations.

B. Description of Proposal and Alternatives

1. Alternative I (Proposal):

a. Description of the Proposal: The 479 blocks contained in this proposed action (Fig. II.B.1.a.-1) are scheduled for sale in December 1982 per the 1980 schedule. These blocks are located 98.4 to 287.5 kilometers (61.1-178.6 mi) offshore in water depths which range from 98 to 154 meters (321.5-505.3 ft). The average water depth of the blocks is estimated at 125 meters (410.1 ft). A summary of these blocks by water depth and distance to shore is found in Appendix A of this document. The total aerial extent of the proposed sale area is 1,088,371 hectares (2.7 million acres). Hydrocarbon resource estimates for the proposal are estimated by USGS at 1.12 billion barrels of oil and 3.66 trillion cubic feet of natural gas (see Table II.A.-1). The basin dry risk estimate (the probability of successfully finding commercial amounts of hydrocarbons) is 28 percent for oil and 37 percent for gas. This success probability applies to the proposal as well as each of its alternatives.

Basic Development Assumptions: Environmental, social, and economic impacts may occur as a result of a Federal decision to permit exploration for a commercially producible offshore oil and gas field. Estimated levels of oil and gas discovered are a prime determinant in estimating the amount of activity and impact caused by such a decision.

The focus of this document is on the probability that commercial quantities of hydrocarbons will be found. This then alerts the Secretary of Interior to possible impacts. Further, discussion of oil and gas development activity centers on the more probable intermediate level of assumed resource discovery (the mean case), rather than the more extreme minimum or maximum.

Refer to Sections IV.A.3.a. and b. for detailed discussions of the resources and activities, based on the minimum and maximum cases, of the proposed action.

Estimated Activity Resulting from the Proposal: The amount of commercial activity that may be generated in the St. George Basin area is dependent on

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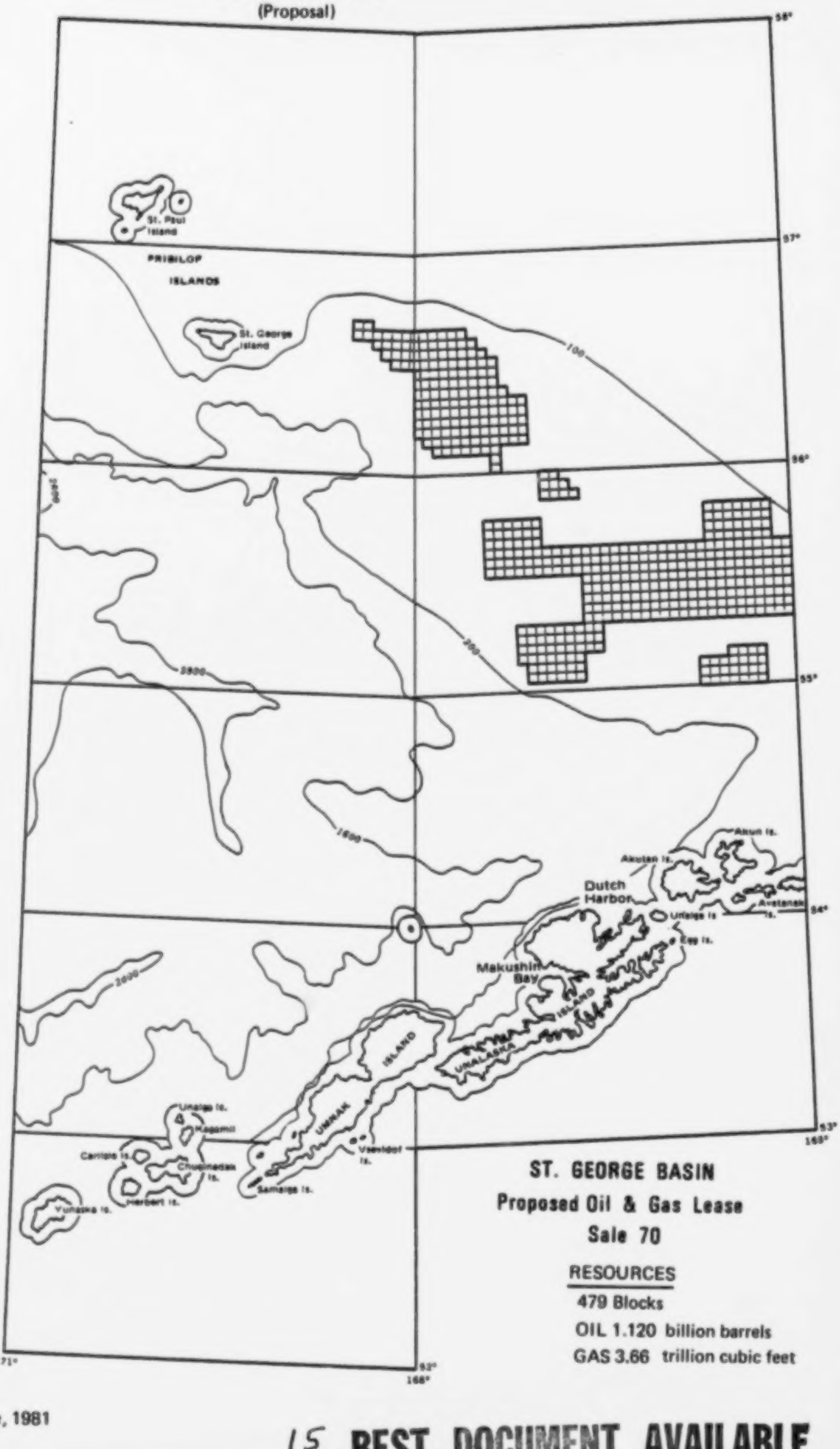
Figure II.B.1.a-1

ALTERNATIVE I

(Proposal)


58°
St. Paul Island
57°
PRIBILOF ISLANDS
St. George Island
100
56°
200
1800
55°
1800
Akun Is.
Akutan Is.
Dutch Harbor
54°
Unalga Is
Avatanak Is.
Egg Is.
Makushin Bay
ISLAND
UNALASKA
2000
ISLAND
UMNAK
Uliaga Is.
Kagamil
Carlisle Is.
Chuginadak Is.
Vsevidof Is.
Samalga Is.
Herbert Is.
Yunaska Is.
53°
163°
171°
52°
168°

ST. GEORGE BASIN

Proposed Oil & Gas Lease

Sale 70

RESOURCES

479 Blocks

OIL 1.120 billion barrels

GAS 3.66 trillion cubic feet

Source: Alaska OCS Office, 1981

many variables. Chief among them would be the amount of recoverable resources. Also of importance would be the availability of capital, work force, equipment, and the willingness of regional and local authorities to work with industry in the implementation of development programs. The quantity of recoverable resources (oil and natural gas) is presently unproven. The following discussion will assume a degree of activity which might be associated with a mean level discovery of hydrocarbons. (Refer to resource estimates in Table II.A.-1.)

Estimated Activity Based on the Mean Scenario: Should the sale be held, the exploratory period of the proposed action (Alternative I) may begin in 1983 and end by 1987 (see Table II.B.1.a.-1). Exploratory drilling activities are expected to peak in 1985, with the employment of 5 drilling rigs and the completion of 15 wells. The average depth of these exploration and delineation wells is expected to be 4,267 meters (14,000 ft). Maximum employment attributable to exploratory activities should occur in 1985 with the expenditure of some 9,540 work-months of labor (see Table II.B.1.a.-2).

If hydrocarbons are located during the exploratory period (the developmental and exploratory phases are not mutually exclusive), the developmental period could begin as early as 1985 with the emplacement of a production platform. The developmental period should cease by 1991. During this period, 11 production platforms may drill as many as 251 production and service wells. (See Table II.B.1.a.-1.) The average depth of a production well could be 3,566 meters (11,700 ft).

Pipeline construction may begin in 1987 and end in 1988. Total pipeline mileage emplaced will vary according to the location of the onshore processing facilities. Approximate pipeline lengths for three onshore locations are shown in Table II.B.1.a.-1. Pipeline diameters needed to move the resources of the proposal have been calculated by the U.S. Geological Survey to be 30 inches for oil and 22 inches for gas (Adams, personal communication, 1980). The pipelines should be laid entirely underwater except for the final few kilometers. However, if a facility is located at a port on the south side of the Alaska Peninsula (such as Ikatan Bay), the approximate final 48 kilometers (30 mi) of pipe would have to travel over land. Oil production is expected to begin in 1989 and reach a peak output of 242 MMbbls in 1991. Gas production could also begin in 1989; however, peak production of gas would not occur until 1993. In that year, some 256 bcf of gas could be extracted (Table II.B.1.a.-1). Maximum employment resulting from developmental activities is expected to occur in 1987, with use of some 72,000 to 73,000 work-months of labor.

Beyond 1991, industry activities could be expected to be confined to production operations. The volume of recovered hydrocarbons is expected to gradually decline, with oil output ceasing 28 years after the sale date (2010) and gas reserves completely exhausted 37 years after the sale date (2019). Employment during this period is expected to remain constant at between 19,679 to 24,002 work-months per year--at least until the depletion of the oil reserves.

b. Mitigating Measures that are Part of the Proposed Action: Laws, regulations, or orders that provide mitigation are considered part of the proposal. Examples include the OCS Lands Act, which grants broad author-

Table II.B.1.a.-1
St. George Sale 70
Mean Case (Alternative I)
Estimated Schedule of Development and Production

Sale Year	Cal. Year	Expl. & Delin. Wells		Plats. and Equip.	Production & Service Wells		Trunk Pipe-lines Kilometers[1]		Shore Terms.	Production	
		No.	Rigs		No.	Rigs	[2] St. Paul	Makushin	No.	Oil MMbbl	Gas bcf
0	1982										
1	1983	8	3								
2		13	5								
3		15	5	1							
4		13	5	3							
5		6	2	4	50	6	418	560	.5		
6				2	80	9	420	562	.7		
7				1	60	7			.6	57	28
8					40	5			.2	184	127
9					21	3				242	219
10										186	248
11										119	256
12										81	251
13										57	239
14										41	231
15										31	226
16										24	223
17										19	220
18										12	218
19										10	217
20										8	215
21										7	192
22										6	156
23										5	114
24										4	76
25										4	52
26										3	37
27										3	27
28										2	21
29											16
30											12
31											9
32											8
33											6
34											5
35											4
36											4
37											3
TOTAL		55	20	11	251	30	838	1,112	2	1120	3660

[1] Kilometers indicated are for both oil and gas pipelines.

[2] Pipeline kilometer distance to a southern Alaska Peninsula bay is roughly equivalent to that of St. Paul.

Sources: USGS, 1980; BLM/Alaska OCS Office, 1981.

Table II.B.1.a.-2
St. George Basin Sale 70
Alternative I
Estimated Employment -
Exploratory Phase
(Based on Revised Resource Estimates Received from USGS 9/17/80)

Year	Drilling Rigs[1/] (Mining)	Shore Bases (Mining)	Transportation	Total Work-Months	Average Monthly Employment
1982	Sale				
1983	3,232	360	1,720	5,312	443
1984	5,252	360	2,720	8,332	694
1985	6,060	360	3,120	9,540	795
1986	5,252	360	2,720	8,332	694
1987	2,424	360	1,320	4,104	342
1988					

1/ Assume 4 months to drill 1 exploratory well.

Source: Alaska OCS Office, 1981.

ity to the Secretary of the Interior to control lease operations, the OCS Operating Orders, coastal zone management regulations, the Fisherman's Contingency Fund, and the Offshore Oilspill Pollution Fund. (Refer to Alaska OCS Technical Paper No. 4, Legal Mandates and Federal Regulatory Responsibilities, for detailed discussions (Casey, 1981). Also, refer to Appendix C, Summary of Arctic OCS Operating Orders, prepared by USGS.)

c. Potential Mitigating Measures: A Secretarial decision on the following mitigating measures has not occurred; they are noted here as potential measures which could further mitigate impacts resulting from this proposed lease sale. Some of these measures have been imposed by the Secretary in past lease sales and are likely to continue to be used unless more effective mitigating measures are identified or developed. If any of these measures are adopted, they will appear in the Final Sale Notice. The impact analysis in this environmental impact statement does not assume that the following measures are in place. The measures are, however, evaluated in the Effect of Additional Mitigating Measures sections within each assessment (Sec. IV), as well as briefly described in this section.

The potential mitigating measures described in this section are based on suggestions made during the scoping process for proposed sale 70, comments in response to the Call for Nominations and Tract Selection, as well as the analyses completed by staff members of the Alaska OCS Office. All available information on potential mitigating measures for the St. George Basin was evaluated in the environmental assessment process. A field level interagency coordination meeting was held on June 23, 1981 to further discuss and evaluate potential measures, in accordance with Department Manual No. 655. In attendance at the meeting were representatives from the Bureau of Land Management, U.S. Geological Survey, and the U.S. Fish and Wildlife Service.

(1) Potential Stipulations:

Protection of Cultural Resources

If this measure were adopted, it is most likely that it would be invoked for blocks 341, 342, 385 through 390, 431 through 434, 476, 477, 478, 521, and 522 (17 blocks) (Official Protraction Diagram NO 2-8). In the proposed sale area, these blocks have the highest probability of having been inhabited during prehistoric and historic times (Dixon, Sharma, and Stoker, 1976).

It is possible that surveys may also be required for the following 99 blocks where shipwrecks may be present: 212, 213, 214, 256 through 259, 300 through 303, 344 through 348, 385 through 392, 430 through 437, 474 through 481, 519 through 526, 563 through 570, 607 through 614, 652 through 659, 696 through 703, 674 through 677, 917 through 921, 961 through 965, and 1005 through 1009 (Official Protraction Diagram NN 3-1).

> If the DCM (Deputy Conservation Manager, Offshore Field Operations, Alaska Region, USGS), has reason to believe that a site, structure, or object of historical or archaeological significance (hereinafter referred to as a "cultural resource") may exist in the lease area and the DCM gives the lessee written notice that the lessor is invoking the provisions of this stipulation, the lessee shall upon receipt of such notice comply with the following requirements.

Prior to any drilling activity or the construction or placement of any structure for exploration or development on the lease, including but not limited to well drilling and pipeline platform placement (hereinafter in this stipulation referred to as "operation"), the lessee shall conduct remote sensing surveys to determine the potential existence of any cultural resource that may be affected by such operations. All data produced by such remote sensing surveys, as well as other pertinent natural and cultural environmental data, shall be examined by a qualified marine survey archaeologist to determine if indications are present suggesting the existence of a cultural resource that may be adversely affected by any lease operation. A report of this survey and assessment prepared by the marine survey archaeologist shall be submitted by the lessee to the DCM and the Manager, Bureau of Land Management (BLM), Outer Continental Shelf (OCS) Office, for review.

If such cultural resource indicators are present, the lessee shall (1) locate the site of such operation so as not to adversely affect the identified location; or (2) establish, to the satisfaction of the DCM, on the basis of further archaeological investigation conducted by a qualified marine survey archaeologist or underwater archaeologist using such survey equipment and techniques as deemed necessary by the DCM, either that such operation shall not adversely affect the location identified or that the potential cultural resource suggested by the occurrence of the indicators does not exist.

A report of this investigation prepared by the marine survey archaeologist or underwater archaeologist shall be submitted to the DCM and the Manager, BLM OCS Office, for their review. Should the DCM determine that the existence of a cultural resource which may be adversely affected by such operation is sufficiently established to warrant protection, the lessee shall take no action that may result in an adverse effect on such cultural resource until the DCM has given directions as to its preservation.

The lessee agrees that if any site, structure, or object of historical or archaeological significance should be discovered during the conduct of any operations on the lease area, he shall report immediately such findings to the DCM and make every reasonable effort to preserve and protect the cultural resource from damage until the DCM has given directions as to its preservation.

Evaluation of Effectiveness: OCS Order 2.1.3 requires the lessee to perform, on the well site, shallow geologic hazard surveys or other surveys as required by the DCM. No specific mention is made of cultural resource surveys. This measure applies specifically to cultural resources that may be present in the proposed sale area. Included in the measure are a list of blocks that have the highest probability of containing cultural resources, a procedure for the detection of such resources, and a requirement that if such resources are found that they be protected. This measure would minimize the possibility of damage to or destruction of cultural resources within the proposed sale area.

Orientation Program

There is concern that uninformed workers and subcontractors could unknowingly destroy or damage the environment, be insensitive to local historical or cultural values, as well as biological resources, or unnecessarily disrupt the local economy. Due to the importance of subsistence, lifestyle, economics, and fish wildlife resources in the St. George Basin area, these issues would be covered in the proposed orientation program. These subjects have been identified in the scoping process as major concerns.

This potential mitigating measure would provide increased protection to the environment and addresses concerns of local residents. Similar programs were implemented for the Trans-Alaska Pipeline and in the lower Cook Inlet, Eastern Gulf of Alaska, and Beaufort Sea OCS lease sale areas.

> The lessee shall include in any exploration and development plans submitted under 30 CFR 250.34 a proposed environmental training program for all personnel involved in exploration or development activities (including personnel of the lessee's contractors and subcontractors) for review and approval by the DCM (Deputy Conservation Manager, Offshore Field Operations, Alaska Region, USGS). The program shall be designed to inform each person working on the project of specific types of environmental, social, and cultural concerns which relate to the individual's job. The program shall be formulated by qualified instructors experienced in each pertinent field of study, and shall employ effective methods to insure that personnel are informed of archaeological, geological, and biological resources including bird colonies and sea mammal haul-out areas, to insure the importance of avoidance and non-harassment of wildlife resources. The program shall be designed to increase the sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which such personnel will be operating. The program shall also include information concerning the domestic and foreign fishing industries in order to reduce potential conflicts.
>
> The lessee shall also submit for review and approval a continuing technical environmental briefing program for supervisory and managerial personnel of the lessee and its agents, contractors, and subcontractors.

Evaluation of Effectiveness: This measure provides a positive mitigating effect in that it makes the workers aware of the unique environmental, social, and cultural values of the local residents and their environment. This orientation program would promote an understanding of and appreciation for local community values, customs, and lifestyles of Alaskans without creating undue costs to the lessee. It would also provide necessary information to personnel which could result in minimized behavioral disturbance to wildlife and minimized conflict between the commercial fishing industry and the oil and gas industry.

Transportation of Hydrocarbon Products

This measure was adopted for OCS lease sales 42, 48, and 55 (open ocean areas). Citation of the Port and Tanker Safety Act of 1978, as amended (33 U.S.C. 1221), was added to the measure:

Pipelines will be required (a) if pipeline right-of-way can be determined and obtained; (b) if laying such pipelines is technically feasible and environmentally preferable; and (c) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple use conflicts. The lessor specifically reserves the right to require that any pipeline used for transporting production to shore be placed in certain designated management areas. In selecting the means of transportation, consideration will be given to any recommendation of the intergovernmental planning program for assessment and management of transportation of OCS oil and gas with participation of Federal, State, and local government and industry.

All pipelines, including both flow lines and gathering lines for oil and gas, shall be designed and constructed to provide for adequate protection from water currents, storms and ice scouring, subfreezing conditions, and other hazards as determined on a case-by-case basis.

Following the development of sufficient pipeline capacity, no crude oil will be transported by surface vessel from offshore production sites, except in the case of emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the DCM.

Where the three criteria set forth in the first sentence of this stipulation are not met and surface transportation must be employed, all vessels used for carrying hydrocarbons to shore from the leased area will conform with all standards established for such vessels, pursuant to the Ports and Waterways Safety Act of 1972 (46 U.S.C. 391a), and the Port and Tanker Safety Act of 1978, as amended (33 U.S.C. 1221).

Evaluation of Effectiveness: The intent of this measure is to transport hydrocarbons by the environmentally preferable and safest method. The measure has been adopted for most recent lease sales, but has not yet been implemented for Alaska since there have been no commercial discoveries of oil or gas on the Alaska OCS.

(2) Information to Lessees:

The mitigating measures considered as Information to Lessees provide the lease operators with notice of special concerns in or near the lease area. These measures, however, are merely advisory in nature and carry no specific enforcement authority by the Department of the Interior (DOI), in most cases. DOI's authority extends to operations actually conducted on the leasehold. Regardless of their advisory nature, these measures do provide a positive mitigation by creating greater awareness on the part of the operator of these special concerns.

The following measures were agreed to at the field level interagency coordination meeting held on June 23, 1981.

Information on Bird and Marine Mammal Protection

Bidders are advised that during the conduct of all activities related to leases issued as a result of this lease sale, the lessee and its agents, contractors, and subcontractors will be subject to the provisions of the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, as amended, and International Treaties.

The lessee or its contractors should be aware that disturbance of wildlife could be determined to constitute harassment, and thereby be in violation of existing laws. Violations under these acts and treaties may be reported to the National Marine Fisheries Service or U.S. Fish and Wildlife Service, as appropriate. Behavioral disturbance of most birds and mammals found in or near the proposed sale 70 area would be unlikely if vessels and aircraft maintained at least a 1-mile distance from observed wildlife or known wildlife concentration areas such as bird colonies and marine mammal haul-out and rookery areas. Therefore, in concurrence with the U.S. Fish and Wildlife Service, it is recommended that aircraft or vessels operated by lessees maintain at least a 1-mile distance from observed or known wildlife concentrations. Human safety will take precedence at all times.

Of particular concern are wildlife populations of the Pribilof Islands, Izembek Lagoon, and other coastal wilderness or refuge areas. For guidance regarding prohibited activities, attention of the lessees is directed particularly to existing National Wildlife Refuge System rules, 50 CFR, Parts 27 and 215, and Part 36, rules for the Alaska National Wildlife Refuges (46 FR 31818 June 17, 1981), wherein 36.21(c) states "The operation of aircraft at altitudes and in flight paths resulting in the herding, harassment, hazing, or driving of wildlife is prohibited."

Maps locating major wildlife concentration areas are available for route planning from the DCM (Deputy Conservation Manager, Offshore Field Operations, Alaska Region, USGS), and appropriate resource agencies.

Evaluation of Effectiveness: Conformance by lessees with the recommendations described above would help to ensure that behavioral disturbance of wildlife, particularly at known concentration areas, would be minimized. Maps provided to the DCM would clearly designate locations habitually used as concentration areas. Tract specific recommendations may be made by the DCM, as appropriate. Appropriate authorities may issue more specific regulations under existing legislation that could further minimize behavioral disturbance to wildlife.

Information on Coastal Zone Management

Lessees are advised that, after identifying potential OCS related facility sites, they may wish to consult with the local planning agencies in the Aleutian and Pribilof Islands, as appropriate, and state agencies involved in coastal zone area review in order to provide coordination in coastal zone development and the siting of energy facilities. Lessees should realize that the Aleutian and Pribilof Islands lack Coastal Resource Service Area (CRSA) boards and approved district Coastal Management Programs (CMP). Early coordination with the appropriate agencies could prevent unsuitable facility siting. Until formation of the CRSA boards and approval of district CMP's, only the state will have review authority regarding the consistency of exploration and development plans with the Alaska Coastal Management Act.

Evaluation of Effectiveness: Conformance by lessees with the recommendation above would help to ensure that coastal zone management regulations are met, even though the Aleutian and Pribilof Islands do not yet have completed coastal zone management programs. The intent of the recommendation is to suggest siting of major energy facilities in the environmentally preferable areas. Appropriate authorities may issue more specific regulations under existing legislation that could further assist proper placement of OCS facilities offshore and nearshore. Appropriate agencies to contact include the Aleutian and Pribilof Islands Coastal Resource Service Area boards (once elected), the Alaska Office of Coastal Management, the Federal Office of Coastal Management, and local planning agencies.

d. Summary of Probable Impacts: The probable impacts are based, in part, on the assumption that the mean resource estimate of 1.12 billion barrels of oil and 3.66 trillion cubic feet of gas would be discovered and produced in the proposed lease sale area. For this amount of oil, according to the U.S. Geological Survey, up to 6.5 oilspills exceeding 1,000 barrels are probable over the 22-year production life of the oil field. There is only a 28-percent chance that commercial quantities of oil would be found, or in other words, a 72-percent chance of not finding oil. If no oil is discovered, of course, there is no risk from potential oilspills or the range of development impacts discussed.

The following discussion assumes that all laws, regulations, and OCS orders are part of the proposal. If the mitigating measures described in Section II.B.1.c. were adopted, it is expected that some impacts described in this environmental impact statement would be reduced. Potential effectiveness of the mitigating measures is described in each impact section.

The extent to which an oilspill would impact demersal fish would depend upon several factors. The eggs and larval stages of these species are the most vulnerable to oil. The probability of an oilspill contacting egg/larval halibut, yellowfin sole, Pacific cod, sablefish, and immature rockfish would be very unlikely. Walleye pollock eggs and larvae could be exposed to oil should a spill occur during the approximate 6-month period from spawning to onset of demersal existence (March-August annually). For pollock, the risk is moderate for spill contact, but insignificant when total pollock egg/larvae distribution and numbers are considered. All north Alaska Peninsula salmon species (principally sockeye) adult and smolt, could be adversely affected by this proposal, principally through interference during offshore migration. Impacts could also occur through reduction in food supply should oilspills reach estuaries. Pink and chum salmon would be the principal salmon species impacted by a tanker loading facility in any one of the bays on the south Alaska Peninsula. Oilspills in these bays could block migration and/or reduce food for both adults and smolt.

The adverse impacts are expected to be largely short-term and recovery thereafter would probably occur after no more than 5 years. The described impacts are not expected to have any significant long-term impact on the salmon resources of Bristol Bay or the south Alaska Peninsula. The probability of interaction is rated as unlikely. Should an interaction occur significant impacts would be unlikely. The overall probability of significant impact is unlikely.

While much of the total Bering Sea crab population remains within the range of possible oilspill impact, only about 5 percent of the combined catch of king and tanner crab are harvested from within the proposed lease areas of the St. George Basin and North Aleutian Shelf. Pavlof, Ikatan, and Morzhovi Bays on the south Alaska Peninsula contain commercial numbers of king, tanner, and dungeness crab. In these relatively confined areas, oilspills could have a significant impact especially on larval forms. Crab of the eastern Bering Sea are distributed over a relatively wide area, thus the risk that an oil pollution event would contact any large part of the total population would be less than for the previously mentioned bays. Some crab mortality could occur during an offshore pipeline installation. Pipelines may act as physical and thermal barriers to crab migrations. Pipe design and installation could provide a solution to these impacts. Already severely depressed shrimp populations in Ikatan, Morzhovi, Pavlof, and Cold-Belkofski Bays on the south Alaska Peninsula could be reduced by chronic or large oil pollution events resulting from developing any one of these areas as a pipeline terminus and associated tanker loading port. The eastern Bering Sea has some pandalid shrimp, but spawning areas are outside the boundaries for any projected spills. Oilspills, reduced fishing area, vessel and gear conflicts, and competition for onshore facilities could all impact the commercial fishery in the eastern Bering Sea and off the south Alaska Peninsula. Oilspills could adversely affect very localized populations of commercial species over short time periods. Area and material conflicts would be local, short-lived, and minor to the fishery as a whole. Probability of interaction is likely; the impacts would be insignificant if interaction occurred. The overall probability of significant impact is unlikely.

Seabirds and waterfowl are extremely sensitive to both oil pollution and disturbance due to increased human activity. Man-made disturbance, particularly noise and human presence, may result in decreased productivity at breeding colonies. Murres, auklets, and other alcids are highly vulnerable to oilspills since they spend much time foraging or resting on the water throughout the year, while waterfowl and shearwaters are somewhat less so. At no time is the St. George Basin area devoid of large numbers of birds, but clearly the greatest number occur during the breeding season, May to October, when vast numbers of seabirds are foraging near the nesting colonies in the Pribilof Islands, eastern Aleutian Islands, south Alaska Peninsula, and Unimak Pass. Waterfowl populations are most vulnerable during spring and fall migration and the post-breeding molt period, when large numbers gather in the lagoons along the north side of the Alaska Peninsula. Oil and gas industry activities could impact bird populations utilizing three areas: 1) shallow offshore and nearshore shelf areas adjacent to the north Alaska Peninsula shore and Unimak Island from May to September; 2) lagoons of the north peninsula shore in spring and fall; and 3) areas adjacent to the peninsula's south side in both winter and summer. Impacts in the areas used by birds near the Pribilof Islands would unlikely be significant except perhaps if support facilities were located on St. Paul Island. Significant impacts on migratory species utilizing Izembek Lagoon would be unlikely unless oil were to enter the lagoon. If interaction were to occur, significant impacts are very likely for certain vulnerable species populations. The overall probability of significant impacts would be unlikely.

Two types of impacts could affect marine mammals in the proposed sale area: environmental contaminants, chiefly oil pollution, and disturbance due to increased human activity. The northern fur seal and the sea otter are the species most vulnerable to impacts from the proposed action. Both rely on fur insulation to maintain body temperature. This insulation would break down upon oiling of the animal. The northern fur seal has a large proportion of its population breeding in the vicinity of the proposed sale area. As a result of pipeline transport of oil across the Alaska Peninsula and tankering from a south side bay, oil and gas industry activities could impact marine mammals utilizing three areas: 1) lagoons and nearshore areas adjacent to the north peninsula shore and Unimak Island, year round; 2) reefs, islands, and nearshore areas adjacent to south shore of the Alaska Peninsula, year round; 3) a broad offshore corridor south of the peninsula to the eastern Aleutian passes in spring and fall. North of the Alaska Peninsula, sea otters would likely incur significant impacts due to their extreme sensitivity to oil, relatively sedentary population, and concentration in this area. Sea lions and harbor seals would not likely experience significant impacts, although contact with oil in areas of high density and breeding activity (Amak Island and Izembek Lagoon) could produce significant local impact. Fur seals migrating offshore would not likely encounter oilspills. If interaction were to occur, such a small percentage of the total population would be involved that a significant impact interaction is considered unlikely.

Major impact-producing agents affecting endangered cetaceans and birds could be oil and gas pollution, noise or other disturbance, and habitat losses. Only portions of the populations of sei, fin, humpback, blue, and sperm whales are suspected of entering the Bering Sea and significant population-wide direct effects would be unlikely even if spills were to occur. Concentrations of gray whales are found in Unimak Pass, along the north side of Unimak Island and along the Alaska Peninsula during spring, and in the northeastern portion of the proposed lease area in fall. Based on oilspill risk analyses, it can be concluded that it is very likely that oilspills would interact with endangered cetaceans or their habitat. It is unlikely that such interaction, if it occurred, would significantly affect endangered whale populations frequenting the area. Therefore, it is unlikely that significant interactions would occur. The unlikely event of a large spill intersecting the gray whale migration is probably the only potential oilspill event that could possibly have a significant impact on an endangered whale population. The overall probability of significant impacts to cetaceans is unlikely. It is unlikely that oilspills would significantly interact with or affect endangered avian species.

In considering population growth and its related impacts, St. Paul, Unalaska, and Cold Bay are the communities most likely to be affected by OCS development. If a terminal facility were located on the south side of the Alaska Peninsula, Cold Bay would have the greatest population effects. OCS-related population would contribute 39 percent (211 persons) of the total population of 543 by 1985 and 56 percent (538 persons) of the total population of 960 persons in 1990. In St. Paul, OCS-induced population would constitute 1 percent or less (less than 10 persons) of total population over the life of the field. Population effects in Unalaska would be most apparent during the initial development phase, when Unalaska serves as a staging area for offshore marine support operations. In 1985, OCS-induced population constitutes 15 percent (528 persons) of the total population of 3,473. Although numerically large in relation to the existing population of about 1,300, the proportion of population induced by OCS operations to total projected population is reduced as a result of the rapid growth of the bottomfishing industry in Unalaska. Consequently, it is likely that significant population impacts could result from the proposal in Cold Bay but unlikely in Unalaska and on the Pribilof Islands.

Significant impacts on local subsistence resources from OCS-induced population would be unlikely in Cold Bay, Unalaska, and the Pribilof Islands. Short-term interaction of subsistence resources with the effects of offshore oilspill incidents would be likely on the Pribilof Islands, very unlikely west of Unimak Pass, and unlikely east of Unimak Pass, although terminal operations on the south side of the Alaska Peninsula could increase the likelihood of local interaction there. The probability of significant impacts on subsistence is likely on the Pribilof Islands should interaction occur, to an extent of possibly reducing meat supply by 30 to 50 percent. Consequently, there is a likely probability of significant impacts on subsistence over the life of the field on the Pribilof Islands and an unlikely probability elsewhere.

Fishing is the basis for village livelihood north and south of the Alaska Peninsula. Among the villages in this area, Nelson Lagoon and False Pass would be more susceptible to the effects of an oilspill than the larger villages of King Cove and Sand Point by virtue of more localized fishing and sole dependency on salmon fishing. Drift and set gillnet fishermen from Nelson Lagoon and False Pass and drift gillnet fishermen from King Cove and Sand Point could be most affected by an oilspill incident from the proposal. A terminal located on the south side of the Alaska Peninsula could increase the risk to salmon fishing grounds located there.

The sociocultural systems of the towns and villages potentially affected by the proposal differ greatly, from Aleut sealing and fishing villages to the boomtown of Unalaska and the frontier settlement of Cold Bay. It is unlikely that significant impacts on sociocultural systems may accrue from the proposal directly in Unalaska or indirectly in any of the fishing villages located east of Unimak Pass. Significant impacts to the sociocultural systems of Cold Bay could result from a terminal sited on the south Alaska Peninsula. If a terminal were sited on the Pribilof Islands, significant impacts on those islands would very likely result.

In general, the community infrastructure requirements are directly related to population growth in the communities and their associated regions. It is easy to see that this population growth is directly related to the direction that oil and gas development would take. St. Paul and the Pribilof Island region would experience minimal additional demands on its infrastructure. The overall probability of significant impacts in St. Paul would be very unlikely. Unalaska's projected demands for housing, educational facilities, sewage system, solid waste disposal, health care, police protection and communication facilities are within the projected base case range and could be adequately met. This projected base case contains large growth predictions associated with the bottomfishing industry. Cold Bay could experience substantial impacts on its community infrastructure due to the high numbers of OCS workers that would likely shuttle through the community. The lack of a formal government would make the additional demands in service more severe than normally would be expected.

Impacts on offshore cultural resources, such as middens, burins, arrowheads, and lamps would most likely occur in the 17 blocks nearest the Pribilof Islands which have a high probability of prior human habitation. The 99 blocks nearest Unimak Pass have a high probability of containing shipwrecks which could be of cultural or historic value. Significant impacts on onshore cultural and archaeological sites would likely occur from increased population due to OCS support facilities. This population increase would mean more visits to cultural, archaeological, and religious sites and, subsequently, possible damage, destruction, looting, or wear to these sites. The final probability of significant impact for any submerged site is estimated to be unlikely. The final probability of significant impact due to increased interaction of the population with onshore cultural resources would be likely.

OCS employment impact in the Aleutian Islands Census Division would begin in 1983, rise very rapidly to a peak in 1987, and drop rapidly thereafter to a 1991 level less than 30 percent that of 1987. After 1991, employment changes would be more gradual. With the location of a terminal on the south side of the Alaska Peninsula, employment impact would peak in 1987 at about 6,400 jobs, most of which would be jobs offshore or in uninhabited locations onshore, and would be filled by nonresident workers who would commute during rest periods to residences outside the census division. The community most affected by this scenario would be Cold Bay with a possible 749 new jobs.

Unalaska could realize about 520 new jobs. Both of these towns have current low unemployment rates, so most of the jobs would be filled by commuters and new residents. St. Paul could obtain 37 new jobs of which 17 positions could be filled by local residents. This small increase in jobs would appear to have noticeable social and economic benefits, viewed in the context of existing unemployment at St. Paul. If the bottomfish industry develops as forecasted, the non-OCS future of the communities of Cold Bay, Unalaska, and St. Paul will provide ample opportunities for employment. One highly probable adverse result of OCS development, even in the absence of the projected expansion of bottomfish activity, would be increased rates of inflation in the impacted communities. Alaska Statutes could provide rent control protection. However, there appears to be no remedy for the very likely increase in price rates for commodities, including food. This could cause hardship among some area residents. In terms of effects on the entire census division, the probability is very likely that this development will have a significant impact in increasing the total number of jobs. However, the probability of significantly reducing unemployment is very unlikely due to the existing low levels of unemployment in most communities.

For the south side of the Alaska Peninsula scenario, impacts on airport and marine facilities of the Pribilof Islands would be minimal. At Dutch Harbor/Unalaska, OCS-induced air traffic would equal one-third of the projected baseline passenger traffic for that terminal. Planned improvements for the Dutch Harbor/Unalaska airport may allow for this increase. The majority of marine impacts would likely occur in the Dutch Harbor/Unalaska area. Significant marine impacts would decrease through time as OCS-support ships and tankers become a decreasing percentage of total vessel traffic as a result of the expanding bottomfishing industry. Cold Bay airfield could require minor facility upgrading to provide for passenger processing and, in the case of expected periods of poor weather, sleeping and eating facilities for work crews stranded on their way to and from work sites. The approaches to some of the bays on the south side of the Alaska Peninsula have shoals and other obstacles which would have to be considered in traffic lane design, if a terminal were to be located in this area. The overall probability of significant impact on the transportation systems of the area as a result of the proposal could be considered as very likely.

The proposed lease sale may have some impact, not necessarily adverse, on the district coastal management program once it is completed. Without knowledge of the possible goals and objective statements for the district coastal management programs regarding OCS facility siting, it is only possible to state that a conflict of some undefined type and intensity could occur.

The cumulative effects which could result from the proposed action and other major projects (Sec. IV.A.7.) would be similar to the impacts which have been previously described. The additional oil and gas exploration and development activities related to other scheduled Federal OCS sales and proposed state lease sales in the Bering Sea and Bristol Bay area could accelerate and increase the described impacts.

2. Alternative II - No Sale:

a. Description of the Alternative: This alternative is one which removes the total area for proposed leasing from further consideration.

b. Summary of Probable Impacts: To eliminate the proposed St. George Basin sale would reduce future OCS oil and gas production, necessitate escalated imports of oil and gas, and/or require the development of alternate energy sources to replace the energy resources expected to be recovered if the proposed sale takes place. Appendix H, Alternative Energy Sources as Alternative to the OCS Program, describes alternative energy sources and their environmental risks and current and projected utilization. Table II.B.2.b.-1 displays the amount of energy needed from other sources to replace the anticipated oil and gas production from the proposal.

3. Alternative III - Delay the Sale:

a. Description of the Alternative: This alternative would delay the start of the proposal as previously described in Section II.B.1.a. for a 2-year period. The purpose for this alternative would be to give additional time for completion of environmental studies. These additional studies and environmental understanding could lessen impacts through improved environmental controls applied to this action. The nature and extent of such controls are unknown. Another purpose for presenting a 2-year delay in the sale was to assess the effects upon the planning process of local communities and organizations affected by the proposed sale.

b. Summary of Probable Impacts: Impacts of the delay of sale alternative would be similar to those of the proposal; delayed but not a-

Table II.B.2.b.-1
Energy Needed from Other Sources to Replace Anticipated Oil and Gas Production from Proposed OCS Sale 70
(Mean Level of Resources if Resources are Found)

Total Crude Oil Production (bbls) (31-year production schedule)	1.12×10^{9}
Total Natural Gas Production (cf)	3.66×10^{12}
Crude Oil BTU Equivalent @ 5.6×10^{6} BTU/bbl (BTU)	6.27×10^{15}
Natural Gas BTU Equivalent @ 1031 BTU/cu.ft. (BTU)	3.77×10^{15}
Total Oil and Gas BTU Equivalent (BTU)	1.00×10^{16}
Alternative Energy Sources Equivalents	
Oil (bbls)	1.79×10^{9}
Gas (cf)	9.70×10^{12}
Coal (tons)	
Anthracite[1]	3.94×10^{8}
Bituminous[2]	3.82×10^{8}
Sub-bituminous[3]	5.26×10^{8}
Lignite[4]	7.47×10^{8}
Oil Shale (tons)[5]	1.43×10^{16}
Tar Sands (tons)[6]	2.38×10^{9}
Nuclear (Uranium Ore) (tons)	1.67×10^{7}
Light Water Reactor[7]	
Breeder Reactor[8]	1.19×10^{5}

1/ 25.4×10^{6} BTU/ton (Williams and Meyers, p. 115).
2/ 26.2×10^{6} BTU/ton (Ibid.)
3/ 19.0×10^{6} BTU/ton (Ibid.)
4/ 13.4×10^{6} BTU/ton (Ibid.)
5/ .7 barrels/ton (SPPP, p. 2-3).
6/ 4.2×10^{6} BTU/ton (Ibid., p. 5-3).
7/ 100,000 tons of ore = 1,000 Mwe = 3 million tons of coal at 10,000 BTU/lb. (SPPP, p. 6-9).
8/ Uses U-238 isotope, constituting 99.29 percent of naturally occurring uranium. LWR uses U235 isotope, constituting 0.71 percent of naturally occurring uranium.

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voided. A delay would, however, provide additional time for ongoing research to obtain additional data useful in improving the accuracy and precision of impact prediction. The delay would also provide additional time for planning and preparation for community impacts associated with the proposed lease sale.

4. Alternative IV - Deletion near Pribilof Islands: Modification of the proposal by the deletion of 73 blocks located near the Pribilof Islands. The alternative was suggested by Pribilof Island residents and the U.S. Fish and Wildlife Service. It is included to assess the impacts that its adoption would have on the human and biological resources of the Pribilof Islands.

a. Description of the Alternative: This alternative involves the leasing of 406 blocks within the St. George Basin area (Fig. II.B.4.-1). The blocks suggested for leasing under this alternative comprise an area of about 929,979 hectares (2,297,048 acres). The blocks are located approximately 61.1 to 178.6 kilometers (38-111 mi) offshore in water depths of 98 to 154 meters (321.5-505.3 ft). See Appendix A for size, distance from shore, and water depth of each individual block.

According to known geophysical data, the Geological Survey, based on unrisked statistical estimates, projects that the 406 blocks offered in this alternative may contain commercial resources amounting to 1 billion barrels of oil and 2.55 trillion cubic feet of natural gas. A detailed discussion of unrisked statistical estimates can be found in Section IV.A.4.a. The deletion of these blocks would result in a reduction of the estimated recoverable resources by some 120 million barrels of oil and 1.11 trillion cubic feet of gas from that of the proposal.

Exploration is hypothesized to begin in 1983 and continue through 1987 with a total of 50 exploration and delineation wells drilled. Exploratory drilling activities are expected to peak in 1985, with the employment of five drilling rigs.

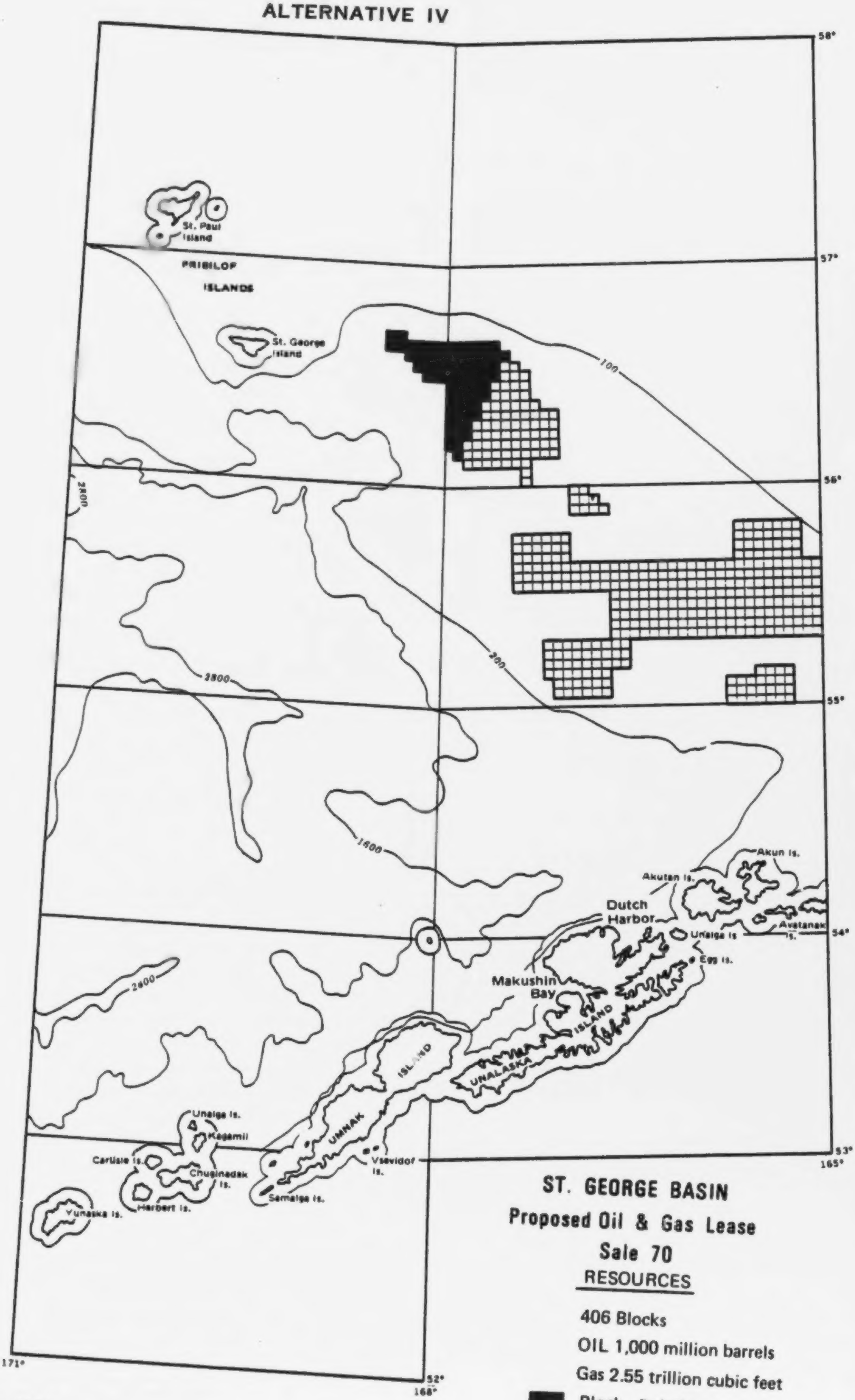
Should recoverable hydrocarbons be located, pipeline construction could begin in 1987 and end in 1988. The construction of pipeline and its length would depend upon the developmental scenario selected (see Table II.B.4.-1).

Oil and gas production could begin by 1989. For oil, the peak production year would be 1991 with nine production platforms and 217 production and service wells. Table II.B.4.-2 gives a comparison of developmental time frames and resources between the proposal and the alternatives. Oil production would cease in 2011 (29 years after the sale date) with gas production ending in 2019 (37 years after the sale date). An estimated schedule of development and production is given in Table II.B.4.-3.

The exploratory, developmental, and transportation infrastructure scenario hypothesized to develop the resources for this alternative probably would vary from that of the proposal or the other alternatives. The scenario matrix displayed in Table II.B.4.-4 compares these developmental scenarios with the alternatives. An expanded treatment of this subject is contained in Alaska OCS Technical Paper No. 1 (Tremont, 1981).

Figure II.B.4.-1

ALTERNATIVE IV


58°
St. Paul Island
57°
PRIBILOF ISLANDS
St. George Island
100
56°
2800
200
2800
55°
1600
Akun Is.
Akutan Is.
Dutch Harbor
Unalga Is
Avatanak Is.
54°
Egg Is.
Makushin Bay
2800
UNALASKA ISLAND
UMNAK ISLAND
Unalga Is.
Kagamil
Carlisle Is.
Chuginadak Is.
Vsevidof Is.
Samalga Is.
Herbert Is.
Yunaska Is.
53°
165°
171°
52°
168°

ST. GEORGE BASIN

Proposed Oil & Gas Lease

Sale 70

RESOURCES

406 Blocks

OIL 1,000 million barrels

Gas 2.55 trillion cubic feet

■ Block Deletions

Source: Alaska OCS Office, 1981

Table II.B.4.-1
Infrastructure and Employment Comparisons Between the Proposal and its Alternatives

	Alternative I Proposal	Alternative IV	Alternative V	Alternative VI
Exploratory Wells	55	50	40	35
Production				
Platforms	11	9	9	8
Wells (including service wells)	251	217	138	108
Peak Employment 1/				
Exploration	9,540	9,136 (1985)	4/	7,234 (1985)
Development				
Onshoré	68-69,000 (1987)	55,101 (1987)	4/	52,219 (1988)
Offshore	43,485 (1987)	3/	3/	3/
Average Production Employment				
Onshore	21,813	19,159	4/	15,084
Offshore	16,507	3/	3/	3/
Pipeline Lengths 2/ and Year Completed	838-1,121 1988	828-840 1988	616-927 1988	603-815 1988
Onshore Processing and Storage Terminal Complex (size in hectares)	200-225	170-190	100-110	70-80

1/ Figures indicate work months.

2/ Length in kilometers. First figure indicates rough distance to location on St. Paul Island, the second indicates distance to Makushin Bay-Unalaska Island. The distance of any proposed pipeline to the south side of the Alaska Peninsula is roughly equal to that of St. Paul.

3/ No estimates for employment under an "offshore" scenario were performed for this alternative.

4/ No employment estimates were calculated for alternative V, as this alternative is believed to be very similar to alternative VI in regard to employment requirements.

Sources: Alaska OCS Office, 1981; Dames and Moore, 1979; USGS.

Table II.B.4.-2
A Comparison of Developmental Timeframes and Resources Between the Proposal and the Alternatives

	Alternative I (Proposal)	Alternative IV	Alternative V	Alternative VI
Begin Exploratory Activities	1983	1983	1983	1983
Begin Developmental Activities	1985	1985	1985	1985
Begin Production	1989	1989	1989	1989
Peak Production				
Year/Oil (MMbbls)	1991-242	1991-214	1990-133	1990-104
Year/Gas (bcf)	1993-256	1992-206	1993-173	1992-144
Average Annual Production				
Oil (MMbbls)	48.7	43.5	25.6	20.4
Gas (bcf)	188	82	82	63
End of Production (by year)				
Oil (MMbbls)	2011	2011	2011	2011
Gas (bcf)	2019	2019	2018	2018

Sources: USGS, 1980; Alaska OCS Office, 1981.

Table II.B.4.-3
St. George Basin Sale 70
Alternative IV

Estimated Schedule of Development and Production

Sale Year	Cal. Year	Expl. & Delin. Wells No.	Expl. & Delin. Wells Rigs	Plats. and Equip.	Production & Service Wells No.	Production & Service Wells Rigs	Trunk Pipelines Miles* St. Paul	Trunk Pipelines Miles* Makushin	Shore Terms. No.	Production Oil MMbbl	Production Gas bcf
0	1982										
1	1983	7	3						1		
2		12	4								
3		14	5	1							
4		12	3	2							
5		5	2	3	45	5	257	261	.1		
6				2	80	9	258	261	.2		
7				1	40	5			.5	58	29
8					30	4			.2	173	115
9					22	3				214	191
10										162	206
11										104	191
12										71	174
13										49	164
14										36	157
15										27	153
16										21	150
17										16	148
18										13	146
19										11	145
20										9	143
21										7	124
22										6	92
23										5	62
24										4	41
25										4	29
26										3	21
27										3	16
28										2	12
29										2	10
30											7
31											6
32											4
33											4
34											3
35											3
36											2
37											2
TOTALS		50	17	9	217	26	515	522	2	1000	2550

* See minimum case footnotes.

Sources: USGS, 1980; Alaska OCS Office, 1981

Table II.B.4.-4
Scenario Matrix

	Alternative I (Proposal)	Alternative IV	Alternative V	Alternative VI
Exploratory Phase				
Marine Support Base				
Dutch Harbor 1/	L	L	L	L
Pribilofs	P	N	P	N
Air Support Base:				
Cold Bay	L	L	L	L
Dutch Harbor 2/	P	P	P	P
Pribilofs	P	N	P	N
Developmental Phase 3/ (Onshore)				
Processing and Terminal Complex				
Makushin Bay	P	P	P	P
Bay on south shore AK Peninsula 3/	L	L	P 4/	P 4/
Pribilofs	P	N	P	N

L = Likely P = Possible N = Not Likely

1/ & 2/ During the developmental phase, should a processing complex be located at Makushin Bay, it is possible that marine and air support activities may be relocated there.

3/ Offshore loading is considered a possibility for all alternatives.

4/ Depending on the developmental strategies used in the proposed sale 75 area, it may be realistic to suppose that produced hydrocarbons from the St. George area could be pumped to a terminal on the south side of the Alaskan Peninsula. A sharing of facilities for both areas may overcome the economic friction of the additional distance.

Source: Alaska OCS Office, 1981.

b. Summary of Probable Impacts: The probable impacts are based on the assumption that 1.00 billion barrels of oil and 2.55 trillion cubic feet of natural gas would be discovered. According to USGS for this amount of oil, up to 5.8 or about 6 oilspills greater than 1,000 barrels could be expected over the 23-year production life of the oil field. This represents an 11-percent decrease in the number of oilspills over that of the proposal, and an 11-percent decrease in the expected production of recoverable resources (Table IV.A.4.b.-1). Potential risk to land segments would be reduced only about 1 percent.

This alternative reduces the likelihood of oil and gas industrial activities on the Pribilof Islands, thus reducing potential impacts on human and biological resources of this area. This deletion affords minor protection from oilspills reaching the Pribilofs, and the blue king and Korean horsehair crabs inhabiting, spawning, and rearing in these areas. Probability of oilspill contact and potential interaction with birds and mammals is similar to the proposal except in the Pribilof Islands vicinity where probabilities are reduced at St. George from 50 to 32 percent and at St. Paul from 15 to 5 percent. A small number of gray whales which summer near the Pribilofs and gray whales migrating south from the northern Bering Sea may be afforded a limited amount of reduced risks of interaction with oilspills as compared to the proposal. The impacts on the social and cultural aspects of the region would be substantially the same as the proposal.

The demand for housing and infrastructure in St. Paul could be 10 to 15 percent lower than those of the proposal. With regards to cultural resources, this alternative removes an area of relatively high probability of prior human habitation and would, as a result, lessen the chance of interaction between OCS activity and marine archaeological sites.

Overall employment impacts in the Aleutian Islands Census Division resulting from the south side of the Alaska Peninsula scenario and Alternative IV would be roughly 85 percent as great as indicated in the proposal. Because infrastructure and employemnt requirements would be less for this alternative, marine and aircraft traffic impacts would be moderately lower than those described for the proposed action.

5. Alternative V - Deletion near Unimak Pass: Modification of the proposal by the deletion of 135 blocks located near the Unimak Pass. This alternative was first suggested by the state of Alaska and the Bristol Bay Borough. It is included to assess the effects in reducing fishing vessel and oil platform conflicts in areas of prime marine resources and in eliminating the threat of oilspills interfering with major salmon migrations.

a. Description of the Alternative: This alternative involves the leasing of 344 blocks within the St. George Basin area (Fig. II.B.5.-1). The blocks suggested for leasing under this alternative comprise an area of about 777,097 hectares (1,919,430 acres). The blocks are located approximately 98.1 to 178.6 kilometers (61-111 mi) offshore in water depths of 98 to 154 meters (321.5-505.3 ft). See Appendix A for size, distance from shore, and water depth of each individual block.

According to known geophysical data, the Geological Survey, based on unrisked statistical estimates, projects that the 344 blocks offered in this alterna-

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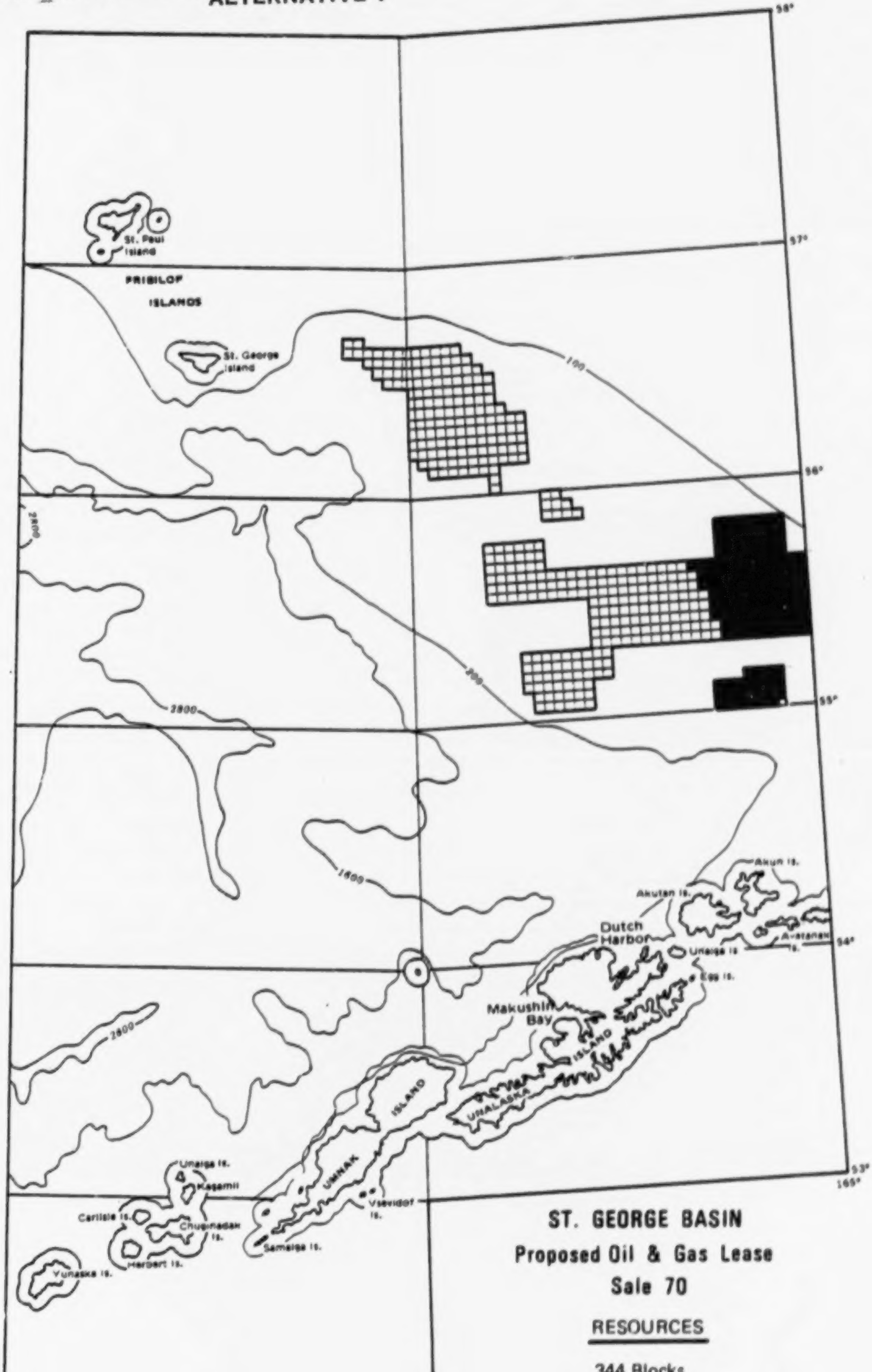
Figure II.B.5.-1
ALTERNATIVE V


58°
St. Paul Island
PRIBILOF ISLANDS
57°
St. George Island
100
56°
2800
200
55°
2800
1600
Akun Is.
Akutan Is.
Dutch Harbor
Unalga Is.
Avatanak Is.
54°
Egg Is.
Makushin Bay
UNALASKA ISLAND
UMNAK ISLAND
2800
Uliaga Is.
Kagamil
Carlisle Is.
Chuginadak Is.
Herbert Is.
Yunaska Is.
Samalga Is.
Vsevidof Is.
53°
165°
171°
168°
52°

ST. GEORGE BASIN
Proposed Oil & Gas Lease
Sale 70

RESOURCES

344 Blocks
OIL 590 million barrels
GAS 2.46 trillion cubic feet
■ Block Deletions

Source: Alaska OCS Office, 1981

tive may contain commercial resources amounting to 590 million barrels of oil and 2.46 trillion cubic feet of natural gas. A detailed discussion of unrisked statistical estimates can be found in Section IV.A.4.a. The deletion of these blocks would result in a reduction of the estimated recoverable resources by some 530 million barrels of oil and 1.2 trillion cubic feet of gas from that of the proposal.

Exploration is hypothesized to begin in 1983 and continue through 1987 with a total of 40 exploration and delineation wells drilled. Exploratory drilling activities are expected to peak in 1985, with the employment of four drilling rigs in the drilling of 12 wells for that year.

Should recoverable hydrocarbons be located, pipeline construction could begin in 1987 and end in 1988. The construction of pipeline and its length would depend upon the developmental scenario selected (see Table II.B.4.-1).

Oil and gas production could begin by 1989. For oil, the peak production year would be 1990 with nine production platforms and 138 production and service wells for the entire production period. Table II.B.4.-2 gives a comparison of developmental time frames and resources between the proposal and the alternatives. Oil production would cease in 2011 (29 years after the sale date) with gas production ending in 2018 (36 years after the sale date). An estimated schedule of development and production is given in Table II.B.5.-1.

The exploratory, developmental, and transportation infrastructure scenario hypothesized to develop the resources for this alternative probably would vary from that of the proposal or the other alternatives. The scenario matrix displayed in Table II.B.4.-4 compares these developmental scenarios with the alternatives. An expanded treatment of this subject is contained in Alaska OCS Technical Paper No. 1 (Tremont, 1981).

b. Summary of Probable Impacts: The probable impacts are based on the assumption that 590 million barrels of oil and 2.46 trillion cubic feet of gas would be discovered. According to USGS for this amount of oil, up to 3.4 or about 3 oilspills greater than 1,000 barrels could be expected over the 23-year production life of the oil field. This represents a 48 percent decrease in the number of oilspills over that of the proposal, and a 47 percent decrease in the expected production of recoverable resources (Table IV.A.4.b.-1). Potential risk to land segments would be reduced only about 3 percent.

Walleye pollock eggs/larvae and larval tanner crab are seasonally widely distributed through the pelagic zone of the waters encompassed by this alternative. The chance of these species being contacted by an oilspill within 3 days after its occurrence is reduced from the proposal's 93 percent to 59 percent. This would be a significant reduction in risk, but pollock egg/larvae are widely distributed over much of the eastern Bering Sea and larval tanner crab are at or near the surface for just a few days after hatching. Some reduction in gear loss, reduced probability of vessel collisions, and reduced risk of oil polluting crab catches would result with this alternative. Oilspill contact and potential interaction with birds is similar to the proposal except in important foraging areas in the vicinity of Unimak Pass and Izembek Lagoon, where it is reduced from likely to very unlikely. The potential for oilspill interaction with marine mammals in important foraging,

Table II.B.5.-1
St. George Basin Sale 70
Alternative V

Estimated Schedule of Development and Production

Sale Year	Cal. Year	Expl. & Delin. Wells No.	Expl. & Delin. Wells Rigs	Plats. and Equip.	Production & Service Wells No.	Production & Service Wells Rigs	Trunk Pipelines Miles* St. Paul	Trunk Pipelines Miles* Makushin	Shore Terms. No.	Production Oil MMbbl	Production Gas bcf
0	1982										
1	1983	5	2						1		
2		10	4								
3		12	4	1							
4		10	4	2							
5		3	1	3	20	3	191	288			
6				2	40	5	192	288	.3		
7				1	30	4			.4	56	27
8					25	3			.3	133	97
9					23	3				122	153
10										77	172
11										51	173
12										35	164
13										25	160
14										19	156
15										14	155
16										11	153
17										9	152
18										7	151
19										6	150
20										5	149
21										4	128
22										3	95
23										3	63
24										2	42
25										2	30
26										2	22
27										2	16
28										1	12
29										1	10
30											7
31											6
32											5
33											4
34											3
35											3
36											2
TOTALS		40	15	9	138	18	383	576	2	590	2460

* See minimum case footnotes.

Sources: USGS, 1980; Alaska OCS Office, 1981.

migration, and breeding areas in the vicinity of Unimak Pass and Izembek Lagoon is reduced from likely to very unlikely. This alternative would delete blocks which pose a moderate to very high oilspill risk to endangered species migration corridors in the Unimak Pass and northern Unimak Island areas.

Total OCS-induced population contributed by this alternative would be approximately half the amount produced by the proposal. With a terminal on the south side of the Alaska Peninsula, impacts on population are the same as the proposal in Unalaska and in the Pribilof Islands. Significant population and sociocultural systems impacts could accrue in Cold Bay. The likelihood of significant impacts on subsistence persists solely for the Pribilof Islands and is absent elsewhere. Impacts on fishing village livelihood are as unlikely as in the proposal. Impacts on community infrastructure may be decreased by half for St. Paul, Unalaska, and Cold Bay from the proposal. Blocks with a high probability of historic shipwrecks are deleted by this alternative, thus lowering the probability of significant impacts to cultural resources from likely to unlikely.

Employment levels would be approximately 55 percent that of Alternative I. Transportation system impacts resulting from this alternative would be substantially lower than those forecast for the proposed action.

6. Alternative VI - Deletion near Pribilof Islands and Unimak Pass: Modification of the proposal by the deletion of 208 blocks located near the Pribilof Islands and the Unimak Pass. This alternative combines the deletions offered in Alternatives IV and V and is included to assess the combined effects of those block deletions.

a. Description of the Alternative: This alternative involves the leasing of 271 blocks within the St. George Basin area (Fig. II.B.6.-1). The blocks suggested for leasing under this alternative comprise an area of about 618,939 hectares (1,528,779 acres). The blocks are located approximately 98.1 to 178.6 kilometers (61-111 mi) offshore in water depths of 98 to 154 meters (321.5-505.3 ft). See Appendix A for size, distance from shore, and water depth of each individual block.

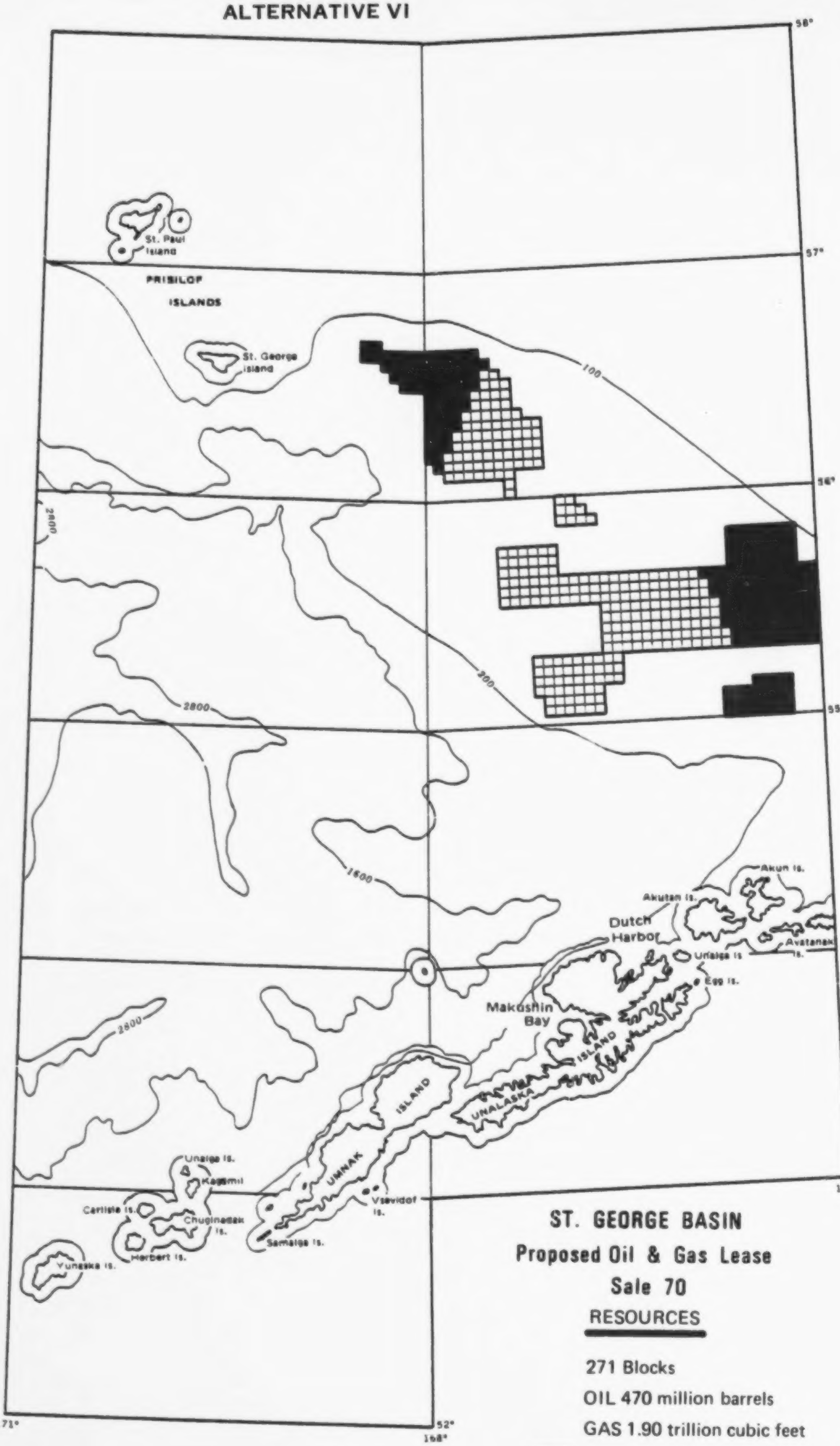
According to known geophysical data, the Geological Survey, based on unrisked statistical estimates, projects that the 271 blocks offered in this alternative may contain commercial resources amounting to 470 million barrels of oil and 1.90 trillion cubic feet of natural gas. A detailed discussion of unrisked statistical estimates can be found in Section IV.A.4.a. The deletion of these blocks would result in a reduction of the estimated recoverable resources by some 650 million barrels of oil and 1.76 trillion cubic feet of gas from that of the proposal.

Exploration is hypothesized to begin in 1983 and continue through 1987 with a total of 35 exploration and delineation wells drilled. Exploratory drilling activities are expected to peak in 1985, with the employment of four drilling rigs.

Should recoverable hydrocarbons be located, pipeline construction could begin in 1987 and end in 1988. The construction of pipeline and its length would depend upon the developmental scenario selected (see Table II.B.4.-1).

Figure II.B.6.-1

ALTERNATIVE VI



58°
St. Paul Island
57°
PRIBILOF ISLANDS
St. George Island
100
56°
2800
200
2800
55°
1800
Akun Is.
Akutan Is.
Dutch Harbor
Avatanak Is.
54°
Unalga Is
Egg Is.
Makushin Bay
2800
ISLAND
UNALASKA
ISLAND
UMNAK
Unalga Is.
Kagamil
Carlisle Is.
Chuginadak Is.
Vsevidof Is.
Samalga Is.
Herbert Is.
Yunaska Is.
53°
165°
171°
52°
168°

ST. GEORGE BASIN

Proposed Oil & Gas Lease

Sale 70

RESOURCES

271 Blocks

OIL 470 million barrels

GAS 1.90 trillion cubic feet

■ Block Deletions

Source: Alaska OCS Office, 1981

Oil and gas production could begin by 1989. For oil, the peak production year would be 1990 with eight production platforms and 108 production and service wells. Table II.B.4.-2 gives a comparison of developmental time frames and resources between the proposal and the alternatives. Oil production would cease in 2011 (29 years after the sale date) with gas production ending in 2019 (36 years after the sale date). An estimated schedule of development and production is given in Table II.B.6.-1.

The exploratory, developmental, and transportation infrastructure scenario hypothesized to develop the resources for this alternative probably would vary from that of the proposal or the other alternatives. The scenario matrix displayed in Table II.B.4.-4 compares these developmental scenarios with the alternatives. An expanded treatment of this subject is contained in Alaska OCS Technical Paper No. 1 (Tremont, 1981).

b. Summary of Probable Impacts: The probable impacts are based on the assumption that 470 million barrels of oil and 1.90 trillion cubic feet of gas would be discovered. According to USGS for this amount of oil, up to 2.7 or about 3 oilspills greater than 1,000 barrels could be expected over the 23-year production life of the oil field. This represents a 58 percent decrease in the number of oilspills over that of the proposal, and a 58 percent decrease in the expected production of recoverable resources (Table IV.A.4.b.-1). Potential risk to land segments would be reduced only about 7 percent.

This alternative would reduce the probability of interaction of oilspills and fisheries resources located in the nearshore area of the Pribilof Islands from unlikely to very unlikely. Commercial fishing would have fewer impacts from this alternative in that oilspills, gear loss and/or damage, and vessel collision risk would be reduced. Overall probability of oilspill contact and potential interaction with birds is reduced from likely to unlikely in the Pribilof Islands area and Unimak Pass/eastern Aleutian area. These two regions are important areas for foraging, migrating, and overwintering seabirds and waterfowl. Oilspill contact and potential interaction with marine mammals is reduced from likely to unlikely in two of the most important areas for foraging and migrating fur seals as well as sea lions, the Pribilof Islands and Unimak Pass/eastern Aleutians. Disturbance from transportation activity and human presence also would decrease with this alternative. Deletion of blocks near the Pribilof Islands and Unimak Pass would eliminate potential spill source points which pose relatively high risks to endangered species habitats near the Pribilofs and Unimak Pass.

Total OCS-induced population contributed by this alternative would be approximately half the amount produced by the proposal. Impacts of such population should be the same as the proposal in Unalaska and on the Pribilof Islands. Significant population and sociocultural systems impacts could accrue in Cold Bay. The likelihood of significant impacts on subsistence persists solely for the Pribilof Islands and is absent elsewhere. Impacts on fishing village livelihood are as unlikely as in the proposal. Impacts on infrastructure in St. Paul, Unalaska, and Cold Bay may be decreased by half from those described for the proposal. The alternative would delete blocks which have high probability of prior human habitation and historic shipwrecks.

Table II.B.6.-1
St. George Basin Sale 70
Alternative VI

Estimated Schedule of Development and Production

Sale Year	Cal. Year	Expl. & Delin. Wells No.	Expl. & Delin. Wells Rigs	Plats. and Equip.	Production & Service Wells No.	Production & Service Wells Rigs	Trunk Pipelines Miles 1/ St. Paul	Trunk Pipelines Miles 1/ Makushin	Shore Terms. No.	Production Oil MMbbl	Production Gas bcf
0	1982										
1	1983	4	2								
2		9	3						1		
3		11	4	1							
4		9	3	2							
5		2	1	3	20	3	187	253			
6				2	40	5	188	254			
7					30	4			.3		
8					18	2			.4	45	23
9									.3	104	82
10										98	135
11										62	144
12										40	134
13										28	128
14										20	123
15										15	120
16										11	119
17										9	117
18										7	116
19										6	116
20										5	115
21										4	114
22										3	96
23										3	64
24										2	42
25										2	29
26										2	20
27										1	15
28										1	11
29										1	9
30										1	7
31											5
32											4
33											3
34											3
35											2
36											2
											2
TOTALS		35	13	8	108	14	375	507	2	470	1900

1/ See minimum case footnotes.

Sources: USGS, 1980; Alaska OCS Office, 1981.

Employment impacts in the Aleutian Islands Census Division from this alternative would be about 45 percent as great as indicated for the proposal. This action would lessen impacts on the transportation systems by lowering the estimated tanker movements to 40 percent of the proposal, reducing overall barge traffic entering Unalaska during development to half of that forecast for the proposal, and reducing manpower requirements and, hence, enplanement requirements by at least 25 percent.

C. Comparative Analysis of Alternatives and Impacts

This discussion deals with the most significant differences and similarities among impacts and alternatives in comparison with the proposed action (Alternative I). Refer to Section II.B.1.d. for a summary of impacts that could result from the proposed action.

Alternative II (no sale) would eliminate those impacts described in the proposal. The cancellation of proposed sale 70 could pose potentially adverse impacts on the national economy by continuing dependence on imported oil and gas. Impacts could occur as a result of development of alternative energy sources. Refer to the FEIS for the proposed 5-year oil and gas lease sale schedule, the FEIS for OCS sale 55, Eastern Gulf of Alaska (DOI, 1980), and Appendix H for a general discussion of the potential impacts that could result from various alternative energy sources.

Alternative III (delay the sale) would delay potential impacts of the proposal, but would not avoid them. A reduction in biological and social impacts by some unquantifiable degree could be achieved if the delay were used to strategically plan for community impacts on the St. George Basin area and to fill biological data gaps, especially with regard to fish, birds, and marine mammals. These studies could help to better understand potential impacts on the biological resources of the southern Bering Sea and could provide more information so that potential impacts could be more effectively mitigated. The additional time could also allow for completion of a Coastal Zone Management Plan for the region.

Alternative IV would delete 73 blocks nearest the Pribilof Islands. The alternative reduces the likelihood of oil and gas industrial activities on the Pribilof Islands, thus reducing potential impacts on human and biological resources of this area. This deletion affords minor protection from oilspills reaching the Pribilofs, and the blue king and Korean horsehair crabs inhabiting, spawning, and rearing in these areas. The alternative would reduce the probability of interaction of spilled oil and fisheries resources located in the nearshore areas of the Pribilof Islands from unlikely to very unlikely. Probability of oilspill contact and potential interaction with birds and mammals is similar to the proposal except in the Pribilof Islands vicinity where probabilities are reduced at St. George from 50 to 32 percent and at St. Paul from 15 to 5 percent. This alternative would also eliminate potential spill source points which entail a 47 percent chance that spills would move toward nearshore environments of the Pribilof Islands. A small number of gray whales which summer near the Pribilofs and gray whales migrating south from the northern Bering Sea may be afforded a limited amount of reduced risks of interaction with oilspills as compared to the proposal. The impacts on the social and cultural aspects of the region would be substantially the same as the proposal. The demand for housing and infrastructure in St. Paul could be

10 to 15 percent lower than those of the proposal. With regards to cultural resources, this alternative removes an area of relatively high probability of prior human habitation and would, as a result, lessen the chance of interaction between OCS activity and marine archaeological sites. There would be fewer impacts to onshore cultural resources on the Pribilof Islands. Overall employment impacts in the Aleutian Islands Census Division resulting from the south side of the Alaska Peninsula scenario and Alternative IV would be roughly 85 percent as great as indicated in the proposal. In terms of effects on the entire census division, the probability is very likely that this development will have a significant impact in increasing the total number of jobs. Because infrastructure and employemnt requirements would be less for this alternative, marine and aircraft traffic impacts would be moderately lower than those described for the proposed action (10-20% reduction). The probability of significant impact would still be very likely. Impacts to potential district Coastal Management Programs would be the same as identified from the proposal, except that impacts to the Pribilof Islands could be less due to a greater distance from the lease area.

Alternative V would delete the southernmost 135 blocks from the proposal, the blocks located nearest the Unimak Pass. Walleye pollock eggs/larvae and larval tanner crab are seasonally widely distributed through the pelagic zone of the waters encompassed by this alternative. The chance of these species being contacted by an oilspill within 3 days after its occurrence is reduced from the proposal's 93 percent to 59 percent. This would be a significant reduction in risk, but pollock egg/larvae are widely distributed over much of the eastern Bering Sea and larval tanner crab are at or near the surface for just a few days after hatching. Some reduction in gear loss, reduced probability of vessel collisions, and reduced risk of oil polluting crab catches would result with this alternative. Oilspill contact and potential interaction with birds is similar to the proposal except in important foraging areas in the vicinity of Unimak Pass and Izembek Lagoon, where it is reduced from likely to very unlikely. The potential for oilspill interaction with marine mammals in important foraging, migration, and breeding areas in the vicinity of Unimak Pass and Izembek Lagoon is reduced from likely to very unlikely. Regionally, significant impacts with seabirds and marine mammals would be unlikely. This alternative would delete blocks which pose a moderate to very high oilspill risk to endangered species migration corridors in the Unimak Pass and northern Unimak Island areas. The probability of significant impact would be very unlikely for cetaceans. Total OCS-induced population contributed by this alternative would be approximately half the amount produced by the proposal. Impacts of such population should be the same as the proposal in Unalaska and on the Pribilof Islands. Significant population and sociocultural systems impacts could accrue in Cold Bay, where OCS-induced population would still present the long-term prospect of comprising 30 to 40 percent of total population. The likelihood of significant impacts on subsistence persists solely for the Pribilof Islands and is absent elsewhere. Impacts on fishing village livelihood are as unlikely as in the proposal. Impacts on community infrastructure may be decreased by half for St. Paul, Unalaska, and Cold Bay from the proposal. Probability of significant interaction would be very unlikely. Blocks with a high probability of historic shipwrecks are deleted by this alternative, thus lowering the probability of significant impacts to cultural resources from likely to unlikely. Employment levels would be approximately 55 percent that of Alternative I, but there still would be a significant increase in total jobs in the census division.

Transportation system impacts resulting from this alternative would be substantially lower than those forecast for the proposed action. They are: a 25-percent reduction in workforce and commuter air traffic; a 40-percent reduction in overall barge traffic; 30- to 35-percent reduction in tanker traffic throughout the life of the field. The probability of significant impacts to transportation would still be very likely. Impacts to potential district Coastal Management Programs for the Aleutian Islands and Alaska Peninsula northeast of Unimak Pass could be diluted due to the greater distance from the proposed sale area.

Alternative VI would delete the 208 blocks comprising a combination of the northern and southern block deletions (Alternative IV and V). This alternative would reduce the probability of interaction of oilspills and fisheries resources located in the nearshore area of the Pribilof Islands from unlikely to very unlikely. The principal species of this resource are blue king and Korean horsehair crabs. Egg and larval forms of walleye pollock and tanner crab are found in the area of the deleted southern blocks, but both species are widely distributed over much of the eastern Bering Sea during these life stages and the probability of significant portions of their populations contacting an oilspill is very unlikely. Commercial fishing would have fewer impacts from this alternative in that oilspills, gear loss and/or damage, and vessel collision risk would be reduced. These reductions are insignificant as probability of significant impact is already assessed as unlikely. Overall probability of oilspill contact and potential interaction with birds is reduced from likely to unlikely in the Pribilof Island area and Unimak Pass/eastern Aleutian area. These two regions are important areas for foraging, migrating, and overwintering seabirds and waterfowl. Oilspill contact and potential interaction with marine mammals is reduced from likely to unlikely in two of the most important areas for foraging and migrating fur seals as well as sea lions, the Pribilof Islands and Unimak Pass/eastern Aleutians. The risk of significant oilspill impacts to seabirds and marine mammals would be unlikely. Disturbance from transportation activity and human presence also would be decreased with this alternative. Deletion of blocks near the Pribilof Islands and Unimak Pass would eliminate potential spill source points which pose relatively high risks to endangered species habitats near the Pribilofs and Unimak Pass. Chance of spills contacting offshore areas north of Unimak Pass is reduced from 7 - 41 percent to 0 - 7 percent. Therefore, significant impacts on such species would be very unlikely. Impacts of such population should be the same as the proposal in Unalaska and on the Pribilof Islands. Significant population and sociocultural systems impacts could accrue in Cold Bay, where OCS-induced population would still present the long-term prospect of comprising 30 to 40 percent of total population. The likelihood of significant impacts on subsistence persists solely for the Pribilof Islands and is absent elsewhere. Impacts on fishing village livelihood are as unlikely as in the proposal. Impacts on infrastructure in St. Paul, Unalaska, and Cold Bay may be decreased by half from those described for the proposal and would be very unlikely to be significant. The alternative would delete blocks which have high probability of prior human habitation and historic shipwrecks. The overall probability of significant impacts to cultural resources would be decreased from likely to very unlikely. Employment impacts in the Aleutian Islands Census Division from this alternative would be about 45 percent as great as indicated for the proposal, but still would represent a significant increase in census division jobs. This action would lessen impacts on the transportation systems by lowering the estimated tanker movements to 40 percent of the proposal, reducing overall barge traffic entering Unalaska during development to half of that forecast for the proposal, and reducing workforce requirements and, hence, enplanement requirements by at least 25 percent. However, stress on air and, to a lesser degree, marine facilities would remain at rather high levels. Significant impacts to transportation systems would still be likely. Impacts to potential district Coastal Management Programs for the Pribilof Islands and the Aleutian Islands could be diluted due to the greater distance away from the proposed sale area.

In summary, in the Oilspill Trajectories Simulations, the proposed action would have a very unlikely to likely chance (12-57%), depending on the transportation scenario, of causing an oilspill of 1,000 barrels or greater to contact land within 10 days. Transportation Scenarios A (pipeline to south side of the Aleutian Islands or Alaska Peninsula) and D (offshore loading) have comparable, low risk to land. Transportation Scenarios B (St. Paul Island terminal) and C (Makushin Bay terminal) have much higher risk. Based on this analysis, careful choice of transportation routes and mode could do more to lessen potential contact with oilspills than proposed block deletions. The locations most at risk by potential oilspills are the Pribilof Islands and the north side of the Aleutian Islands. With the exception of transportation Scenario C in the proposal and Alternative IV, it is unlikely that an oilspill would contact either location within 10 days. None of the deletion alternatives more than halve the probability that spills would reach land. A comprehensive contingency plan for sensitive areas of the Aleutian or Pribilof Islands might reduce risk of oilspill contact to the same extent any of the block deletion alternatives.

III.

DESCRIPTION OF THE AFFECTED ENVIRONMENT

III. DESCRIPTION OF THE AFFECTED ENVIRONMENT

A. Physical Considerations

1. Environmental Geology and Ice Hazards:

a. Geologic Setting: The St. George Basin is a long, narrow structural depression lying near the southern extent of the Bering Sea continental shelf. The longitudinal axis stems northwestward parallel to the continental margin. The longitudinal and cross-sectional dimensions are approximately 300 kilometers (186 mi) by 30 to 50 kilometers (18-31 mi). This elongated feature lies beneath a Bering Sea shelf that offers no bathymetric indication of its existence. Seismic reflection data described in Marlow et al. (1979), (Fig. III.A.1.a.-1), suggests that the basin is filled with over 10 kilometers (32,808 ft) of mostly Cenozoic sedimentary rocks.

The graben which forms the St. George Basin is delineated by major, normal faults that occur in groups and exhibit growth features with depth. Minor faults occur throughout the shelf, however, most are concentrated in the middle of the St. George Basin (Gardner et al., 1979; Fig. III.A.1.a.-2).

A more detailed description of the regional geologic setting, geologic history, and petroleum geology can be found in work by Marlow et al. (1979); Gardner et al. (1979); Cooper et al. (1979); and Dames and Moore (1980).

b. Physiography: The Aleutian chain and the Alaska Peninsula are characterized by rugged volcanic peaks with intermittent areas of rolling topography; a coastline with many deeply indented bays, and numerous small islands. Many of the islands have wave cut platforms up to 183 meters above the present sea level, bordered by low sea cliffs.

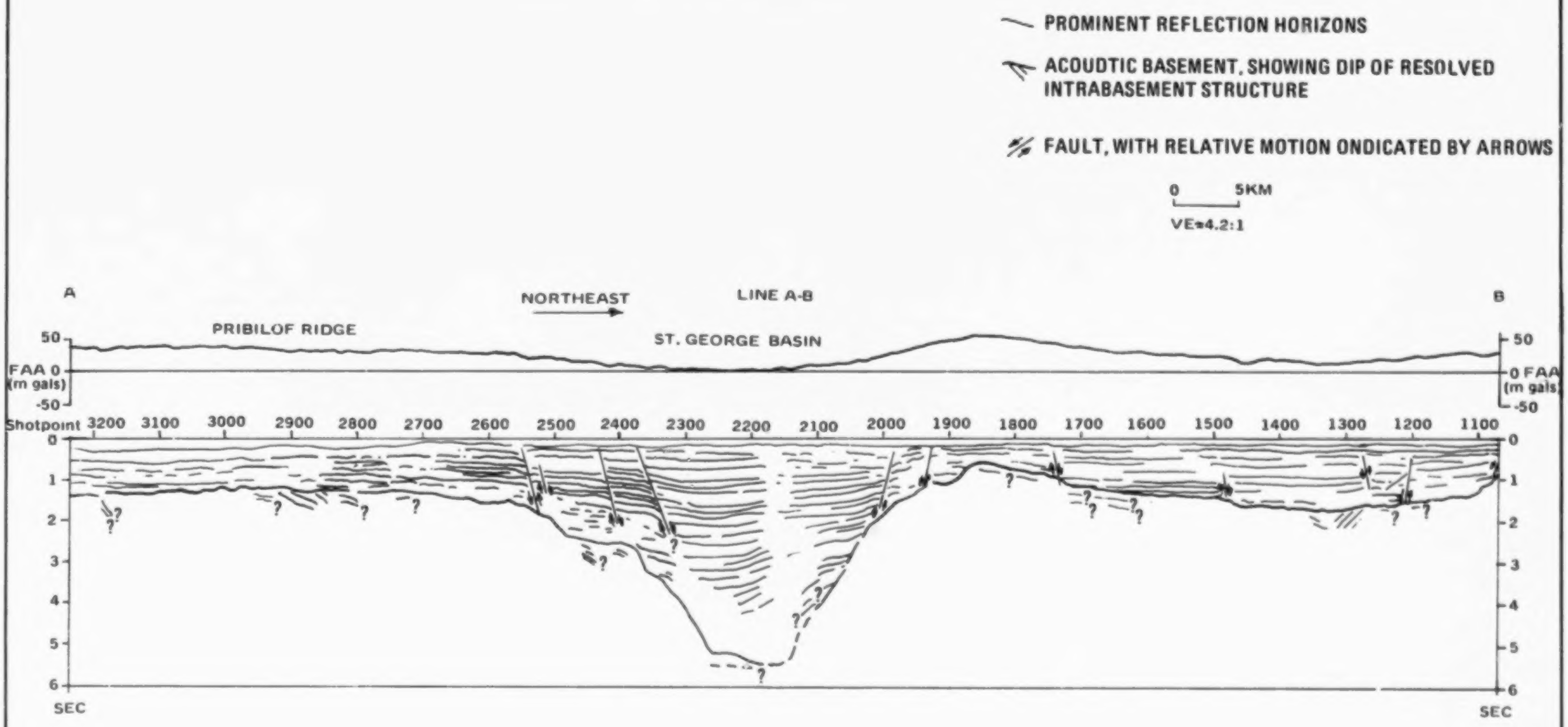
To the north of the St. George Basin, the Pribilof Islands were formed by basaltic outpouring from large fissures. The topography of the islands exhibits volcanic cones, flows, and recent fault scarps. The shorelines consist of layered volcanic cliffs edged by rocky beaches (University of Alaska, AEIDC, 1978).

c. Seismicity and Related Hazards:

Earthquakes: The southern boundary of the proposed sale area is within 500 kilometers (311 mi) of the Aleutian trench, one of the most active seismic zones in the world. The trench is the present site of subduction between the Pacific and North American plates. Most of the seismic energy accumulated as a result of the convergence between these plates is released during great (magnitude greater than 7.8) earthquakes (Kellener, 1970; Sykes, 1971; Pulpan and Kienle, 1980). The after shock zones of these great events do not overlap. The area between two such zones is called a seismic gap and is the most likely site for the next great earthquake. The longer the time interval since the occurrence of the last great event, the greater the probability for the next earthquake.

Using historic and current seismicity data, strong motion accelerograph data, geodetic tilt data, and volcanic activity data, Davies and Jacob (1980) were able to identify a segment of the Aleutian arc near the Shumagin Islands as a

Figure: III.A.1.a.-1

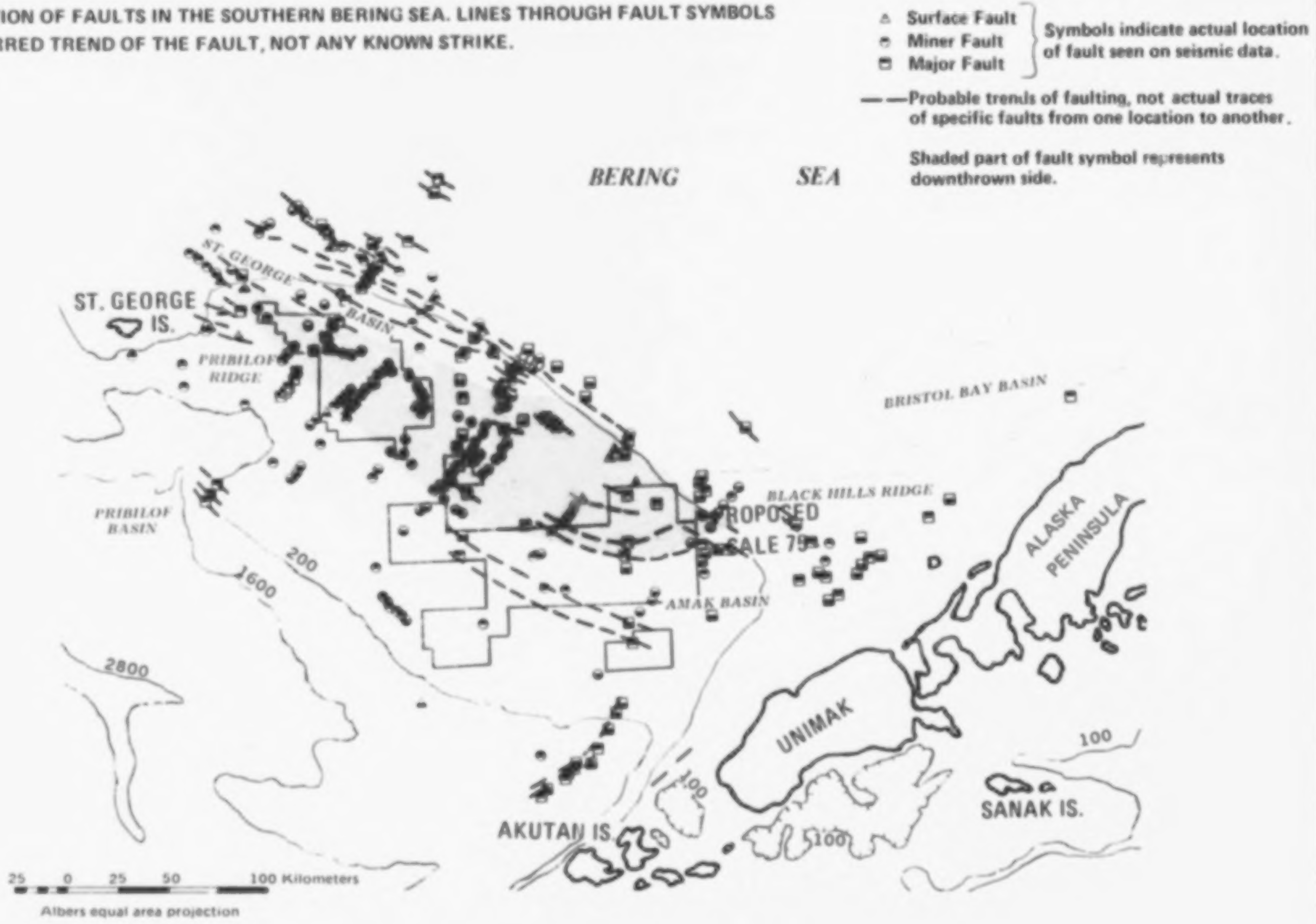

PROMINENT REFLECTION HORIZONS
ACOUDTIC BASEMENT, SHOWING DIP OF RESOLVED INTRABASEMENT STRUCTURE
FAULT, WITH RELATIVE MOTION ONDICATED BY ARROWS
0
5KM
VE=4.2:1
A
NORTHEAST
LINE A-B
B
PRIBILOF RIDGE
ST. GEORGE BASIN
50
FAA 0
(m gals)
-50
Shotpoint 3200 3100 3000 2900 2800 2700 2600 2500 2400 2300 2200 2100 2000 1900 1800 1700 1600 1500 1400 1300 1200 1100
0
1
2
3
4
5
6
SEC
?

INTERPRETATIVE DRAWING OF A SEISMIC–REFLECTION PROFILE PUBLISHED BY MARLOW AND OTHERS (1977). NOTE THAT THE VERTICAL EXAGGERATION APPLIES ONLY TO THE WATER LAYER (ASSUMED VELOCITY OF SOUND IN SEA WATER OF 1.5 KM/SEC) AND WILL DECREASE WITH DEPTH IN THE SECTION. FOR LOCATION OF PROFILE SEE FIGURE 4 III.A.1.c–3

Source: Marlow et al, 1977

Figure: III.A.1.a.–2

DISTRIBUTION OF FAULTS IN THE SOUTHERN BERING SEA. LINES THROUGH FAULT SYMBOLS ARE INFERRED TREND OF THE FAULT, NOT ANY KNOWN STRIKE.


Surface Fault
Miner Fault
Major Fault
Symbols indicate actual location of fault seen on seismic data.
Probable trends of faulting, not actual traces of specific faults from one location to another.
Shaded part of fault symbol represents downthrown side.
BERING SEA
ST. GEORGE IS.
ST. GEORGE BASIN
PRIBILOF RIDGE
PRIBILOF BASIN
BRISTOL BAY BASIN
BLACK HILLS RIDGE
PROPOSED SALE 75
AMAK BASIN
ALASKA PENINSULA
UNIMAK
SANAK IS.
AKUTAN IS.
200
1600
2800
100
25 0 25 50 100 Kilometers
Albers equal area projection

Source: Gardner et al, 1979

BEST DOCUMENT AVAILABLE

seismic gap. According to their studies, this is likely to be the site of one or more great (magnitude greater than or equal to 7.75) earthquakes within the next several years or few decades (Fig. III.A.1.c.-1 and III.A.1.c.-3).

Also, House et al. (1980) have discussed the possibility of a 200 kilometer (124 mi) segment near Unalaska being a mature seismic gap (Fig. III.A.1.c.-1 and III.A.1.c.-3) The pattern of seismicity is nearly identical to that of the Shumagin gap; however, until additional information is known about the area, it may not be possible to resolve the question.

Several intermediate to deep focus (71-300 km or 44-186 mi deep) and many shallow focus (less than 71 km or 186 mi deep) earthquakes have been recorded beneath the southern Bering Sea margin as shown in Figure III.A.1.c.-2 (Marlow et al., 1979). Also, earthquakes with a magnitude of 5.7 have been recorded in the St. George Basin and surrounding area (Meyers et al., 1976).

Faults: Gardner et al. (1979) used seismic reflection data to identify and map the different faults beneath the southern Bering Sea. They were classified into three categories (major, minor, and surface) based on the type and the amount of displacement. The major faults usually penetrate from several hundred meters to several kilometers beneath the sea floor and are generally growth structures. Many displace the acoustic basement. Minor or near surface faults exhibit displacements of five meters (16 ft) or less and most approach to within four or five meters of sea floor (Gardner et al., 1979). Surface faults are any faults that offset the surface of the sea floor. The magnitude of the offset and the recency of movement are two aspects that are used to evaluate them as potential hazards.

The distribution of faults in the southern Bering Sea is shown on Figure III.A.1.a.-2. According to Gardner et al. (1979) the true orientation of most faults is unknown because of the wide spacing of track lines. However, the evidence that is available seems to indicate that the majority of the faults have a northwest to southeast trend and parallel the trend of the basin.

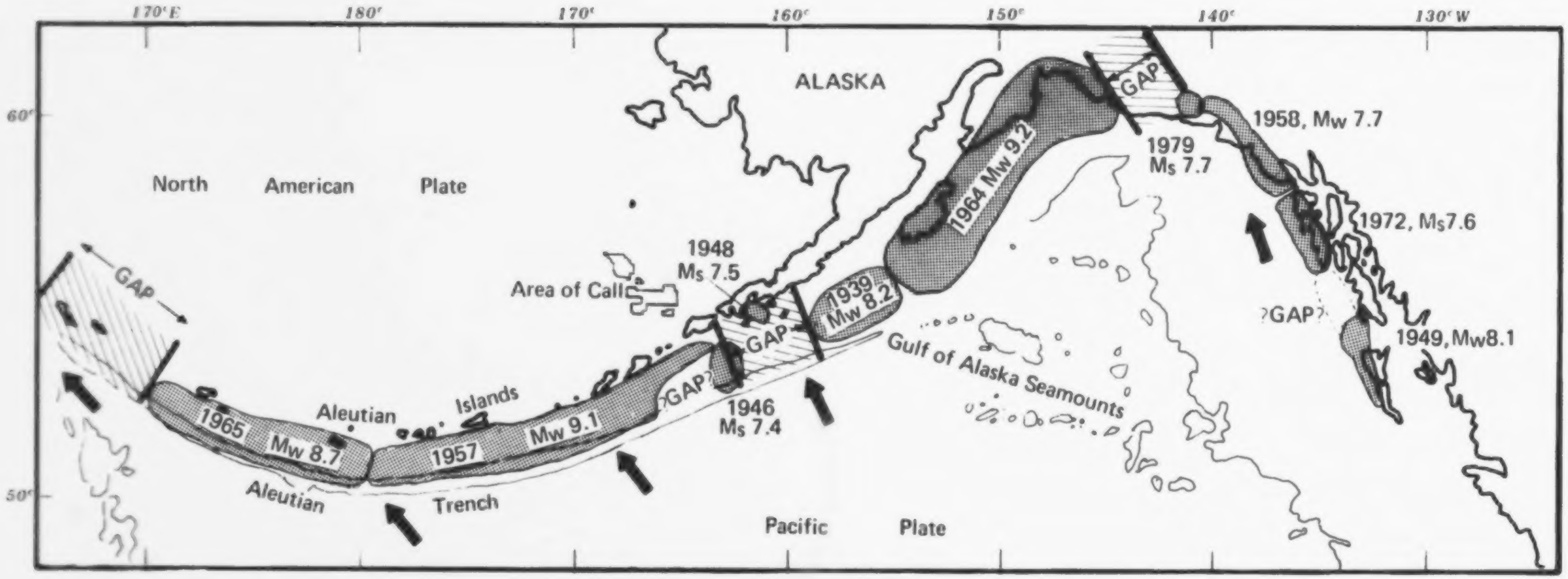
Major or boundary faults clearly outline the St. George Basin and the north side of the Pribilof ridge. These are normal faults which occur in groups; they exhibit offset with depth (Gardner et al. 1979).

Major faults (other than boundary faults) occur within the St. George Basin and display offset as great as 60 meters (197 ft). These faults do not offset in the same sense as adjacent boundary faults, which suggests that deformation has involved more than a simple subsidence.

Minor faults occur throughout the southern outer shelf and are also concentrated in the middle of the St. George Basin. Most of these faults have offsets of less than five meters (16 ft) and almost all approach the sea floor to within four or five meters (13-16 ft).

Surface faults are more abundant along the outer margin of the St. George Basin and along the Pribilof ridge than in the center of the basin. Since these faults can be traced from high resolution to low resolution seismic records, Gardner et al. (1979) suggest that most surface faults are expressions of major or boundary faults.

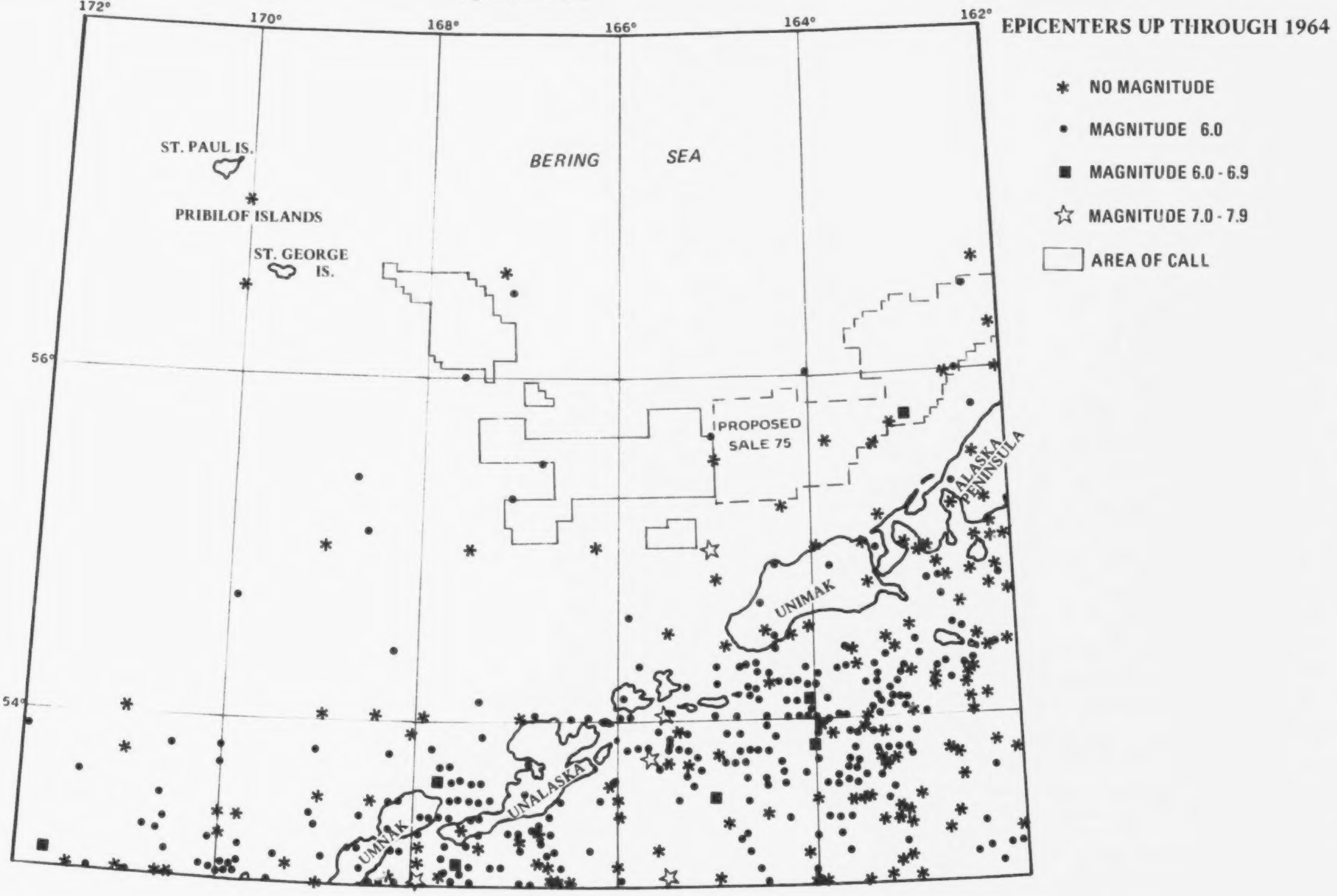
Figure III.A.1.c.-1


170°E
180°
170°
160°
150°
140°
130°W
60°
50°
ALASKA
North
American
Plate
GAP
1964 Mw 9.2
1979
Ms 7.7
1958, Mw 7.7
1972, Ms7.6
1948
Ms 7.5
Area of Call
1939
Mw 8.2
?GAP?
1949, Mw8.1
Gulf of Alaska Seamounts
GAP?
1946
Ms 7.4
1965
Mw 8.7
Aleutian
Islands
1957
Mw 9.1
Aleutian
Trench
Pacific
Plate

AFTERSHOCK AREAS OF EARTHQUAKES OF MAGNITUDE >7.4 IN THE ALEUTIANS, SOUTHERN ALASKA AND OFFSHORE BRITISH COLUMBIA FROM 1938 TO 1979, AFTER SYKES (1971) AND McCANN et al (1979b). HEAVY ARROWS DENOTE MOTION OF PACIFIC PLATE WITH RESPECT TO NORTH AMERICAN PLATE AS CALCULATED BY CHASE (1978) AND JORDAN AND MINSTER (1978). TWO THOUSAND FATHOM CONTOUR IS SHOWN FOR ALEUTIAN TRENCH. M_S AND M_W DENOTE MAGNITUDE SCALES DESCRIBED BY KANAMORI (1977). SHUMAGIN GAP IS IN CENTER OF FIGURE.

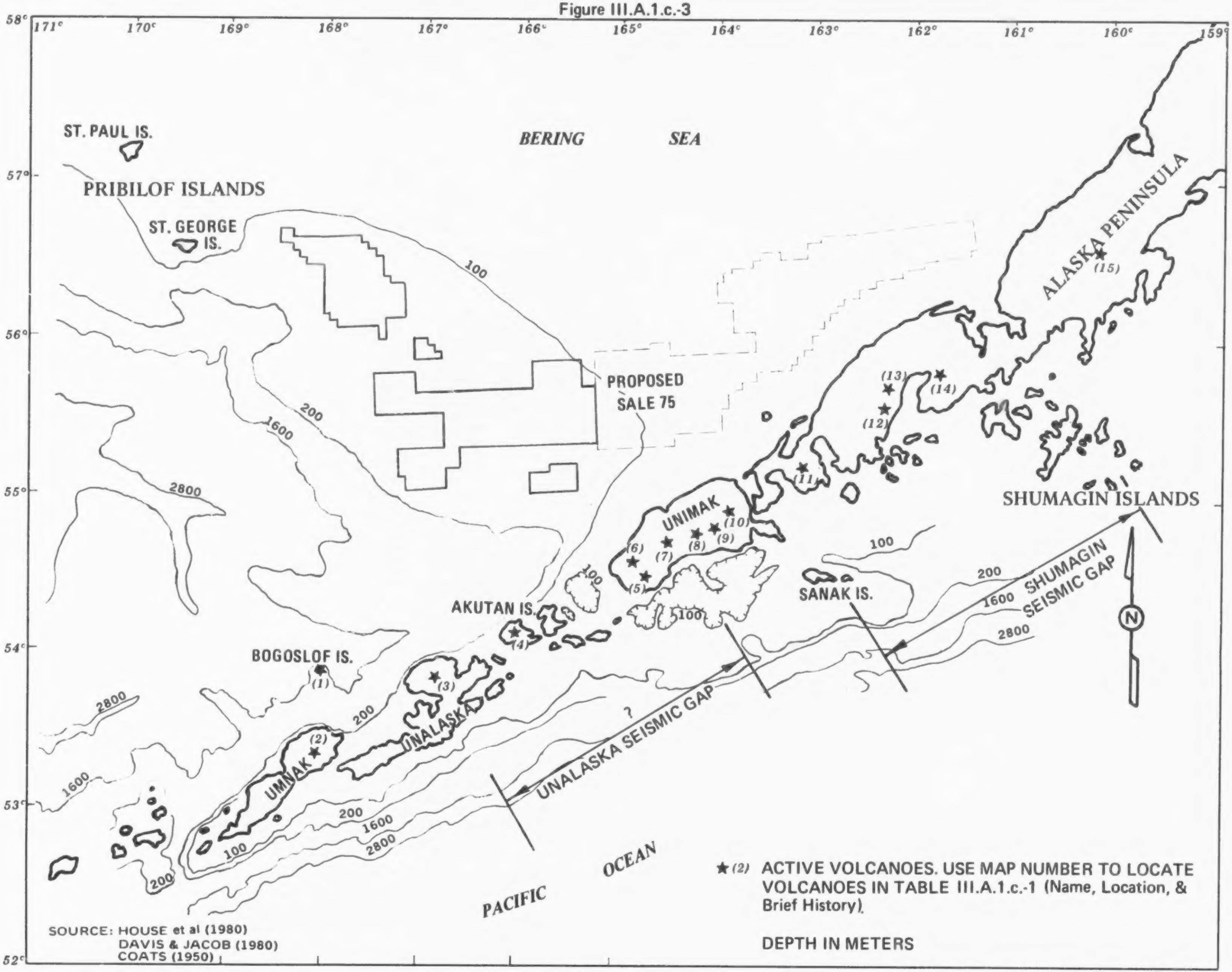
Source: Davies & Jacob, 1980

Figure III.A.1.c.-2


EPICENTERS UP THROUGH 1964
✱ NO MAGNITUDE
● MAGNITUDE 6.0
■ MAGNITUDE 6.0 - 6.9
☆ MAGNITUDE 7.0 - 7.9
☐ AREA OF CALL
172°
170°
168°
166°
164°
162°
56°
54°
ST. PAUL IS.
PRIBILOF ISLANDS
ST. GEORGE IS.
BERING
SEA
PROPOSED SALE 75
ALASKA PENINSULA
UNIMAK
UNALASKA
UMNAK

Source: Marlow et al, 1979

Figure III.A.1.c.-3



58°
171°
170°
169°
168°
167°
166°
165°
164°
163°
162°
161°
160°
159°
57°
56°
55°
54°
53°
52°
ST. PAUL IS.
PRIBILOF ISLANDS
ST. GEORGE IS.
BERING SEA
100
200
1600
2800
PROPOSED SALE 75
ALASKA PENINSULA
(15)
(13)
(14)
(12)
(11)
UNIMAK
(6)
(7)
(8)
(9)
(10)
(5)
SHUMAGIN ISLANDS
SANAK IS.
SHUMAGIN SEISMIC GAP
AKUTAN IS.
(4)
BOGOSLOF IS.
(1)
(3)
UNALASKA
(2)
UMNAK
?
UNALASKA SEISMIC GAP
N
PACIFIC OCEAN

★ (2) ACTIVE VOLCANOES. USE MAP NUMBER TO LOCATE VOLCANOES IN TABLE III.A.1.c.-1 (Name, Location, & Brief History).

DEPTH IN METERS

SOURCE: HOUSE et al (1980)
DAVIS & JACOB (1980)
COATS (1950)

It was the opinion of Marlow et al. (1979) and Gardner et al. (1979) that major faults are probably related to stress fields established by Mesozoic and Cenozoic plate motions and minor faults are related to high seismicity in the subduction zone.

The correlation of earthquakes to shallow faulting is not well understood; however, Marlow et al. (1979) state that many of the faults in the southern Bering Sea may be active and that they respond to earthquake induced energies and possibly to sediment loading.

Volcanic Activity: The proposed sale area is bounded on the south by one of the most volcanically active areas in the world, the Alaska Peninsula/eastern Aleutian Islands arc. Coats (1950), listed 25 active volcanoes on the Aleutian Islands and 11 on the Alaska Peninsula and mainland. Fifteen of these active volcanoes are located within the area of interest for this sale (Fig. III.A.1.c.-3).

The volcanism along this arc is the result of the subduction process related to the convergence between the Pacific and North American plates. The volcanoes are andesitic and are generally the explosive type (Marlow, et al., 1979). Table III.A.1.c.-1 is a list and a brief eruption history of the volcanoes shown on Figure III.A.1.c.-3. Six of the 14 listed have erupted since 1938 (University of Alaska, AEIDC, 1975 and Department of Commerce, NOAA/OCSEAP-SAI, 1981).

To the north of the proposed sale area, there may be active volcanism in the Pribilof Islands (Marlow et al. 1979). These islands were formed by basaltic outpouring from large fissures; evidence of lava flows, spatter cones, and craters can be found (University of Alaska, AEIDC, 1978). Eruptions from basaltic volcanoes are not as violent as the andesitic type found on the Aleutian arc and would only have local effects (Marlow et al. 1979).

Although the major danger related to an explosive volcanic eruption is the direct blast, such as experienced at Mt. Saint Helens in 1980, other potential hazards that are the result of this activity can also be destructive. A paper by Miller and Smith (1977) describes the evidence they found of highly mobile ash flows around the Aniakchak and Fisher Calderas on the Alaska Peninsula. Ash flows on the south side of Aniakchak swept down the glaciated valleys of the volcano, crossed a lowland with an altitude of less than 35 meters (115 ft), and continued on through passes as high as 260 meters (853 ft) into the Pacific Ocean. The travel distance was approximately 50 kilometers (31 mi). On the north side of the Fishers Caldera, evidence indicates that ash flows crossed a 500 meter (1,640 ft) barrier before flowing into the Bering Sea.

Other hazards that can be destructive to onshore or nearshore facilities include lava flows, ash falls, mud slides, flash floods caused by sudden ice or snow melt, and tsunamis and seiches.

Tsunamis and Seiches: Tsunamis can be generated by sudden tectonic displacement of the sea floor or by large landslides and volcanism. Local tsunamis are likely to occur along steep, indented coastlines such as those which exist on the Pacific side of the Alaska Peninsula. Regional tsunamis generated offshore generally have no effect in open water due to greater water depths,

Table III.A.1.c.-1

Active Volcanoes in the Vicinity of the Southern Boundary of Proposed Sale 70

Map No.	Name	Latitude (N)	Longitude (W)	Type of Eruption	Date of Last Eruption
1	Bogoslof	53° 56'	168° 02'	Normal Explosive	1931
2	Okmok	53° 25'	168° 03'	Normal Explosive, Lava	1945
3	Makushin	53° 52'	168° 56'	Normal Explosive	1938
4	Akutan	54° 08'	165° 59'	Normal Explosion, Lava	1973
5	Westdahl	54° 31'	164° 39'	Normal Explosion, Lava	1967
6	Pogromni	54° 34'	164° 41'	Normal Explosion, Lava	1830
7	Fisher	54° 35'	164° 26'	Ash	1826
8	Shishaldin	54° 45'	163° 58'	Lava	1975-76
9	Isanotski Peaks	54° 47'	163° 13'	Normal Explosion, Ash	1845
10	Roundtop Mt.	54° 48'	163° 35'	---	---
11	Frosty Peak	55° 04'	162° 49'	---	---
12	Pavlof	55° 25'	161° 53'	Normal Explosion, Lava	1975-76
13	Pavlof Sister	55° 27'	161° 51'	Ash	1786
14	Dana	55° 38'	161° 13'	---	---
15	Veniaminof	56° 12'	159° 24'	Normal Explosion, Ash	1944

Sources: NOAA-BLM/SAI, 1982
Warrick, 1975

small wave amplitude, and long wave length. However, in lesser depths, the wave amphlitude increases and they become a danger to onshore and shallow water facilities. Seiches are large standing waves generated within enclosed water bodies.

Due to the high probability of major earthquakes occurring in the Shumagin Islands region (Davies et al. 1980), and possibly near Unalaska (House, 1979), there is a strong possibility that a tsunami or seiche will be generated by these tectonic disturbances. During the NOAA/BLM St. George Synthesis meeting held in Anchorage, Alaska in April 1981, Dr. John Davies stated that a major earthquake in the Shumagin Islands region could generate a tsunami with a possible wave height of 30 meters (98 ft).

According to Meyers (1976) there have been 54 instances in recorded history where earthquakes have produced tsunamis or seiches in Alaska. Many have resulted in the loss of lives and property. In April 1946, a 30 meter (98 ft) seismic wave destroyed the Scotch Gap lighthouse on Unimak Island and killed five occupants (Meyers, 1976; Joint Federal/State Land Use Planning Committee (LUPC), 1975). In 1958 an earthquake in southeast Alaska triggered the release of a huge rockslide into Lituya Bay which generated a wave that inundated the entire bay to an elevation of 524 meters (1,719 ft) (LUPC, 1975). Approximately 85 percent of the persons who died during the 1964 Alaska earthquake perished as the direct result of the tsunami (LUPC, 1975).

A more detailed description and history of these hazards can be found in the works of Davies and Jacob (1980), LUPC (1975), and Meyers (1976).

d. Sediments: The surficial cover of the shelf is generally silt to silty sand with gray to greenish hues that indicate reducing conditions. The distribution is shown in Figure III.A.1.d.-1. The finer grain sizes are located over the center of the graben that forms St. George Basin; the coarser sediment coincides with areas of high topographic relief in a shallower depth (Gardner et al. 1979).

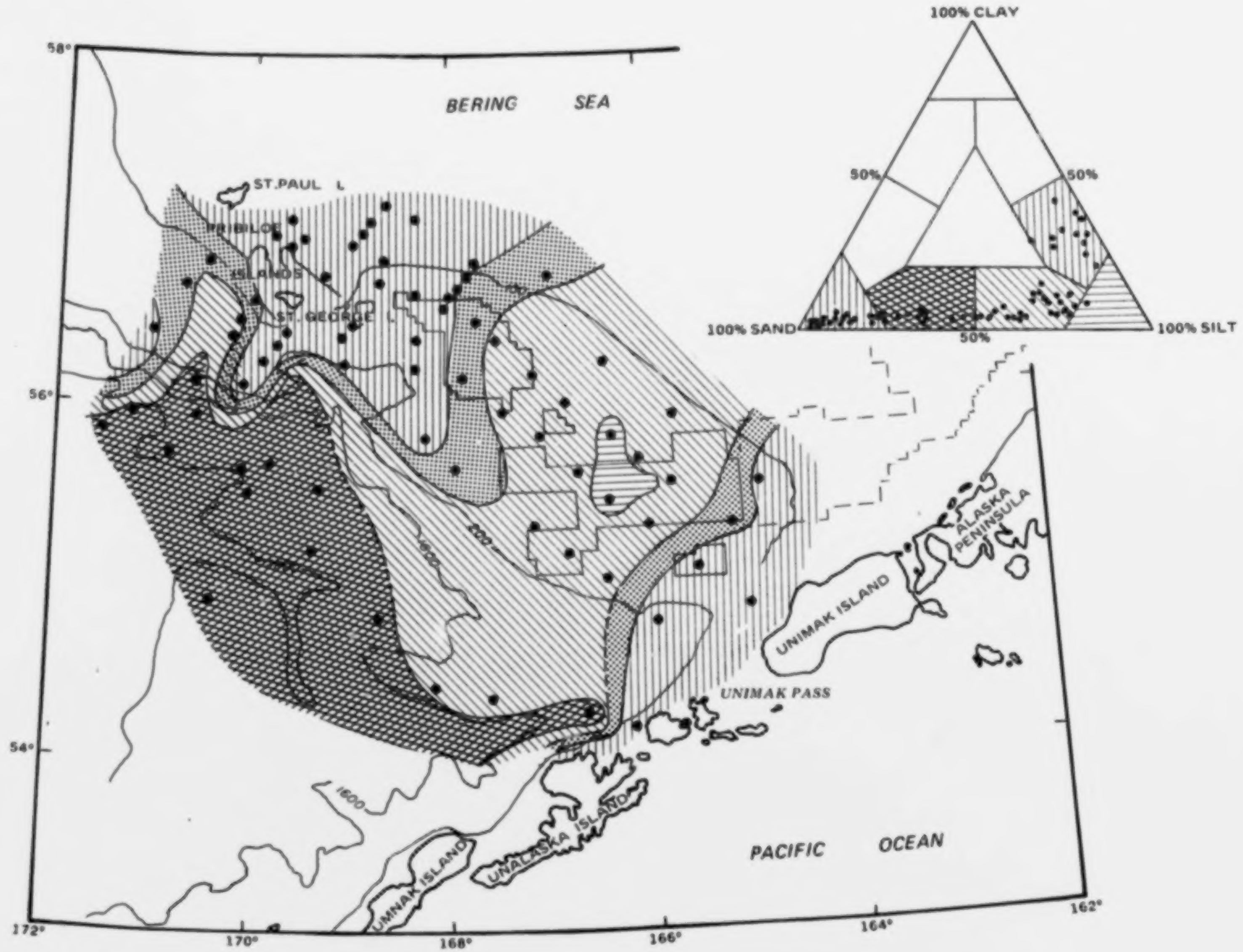
The central portion of the St. George Basin is very poorly sorted, which reflects the lack of significant winnowing. The northwestern border of the Bering Canyon, the head of the Pribilof Canyon, and the topographic high of the Pribilof ridge show moderately-sorted sediment (Gardner et al. 1979 and Fig. III.A.1.d.-2).

Gardner et al. (1979) concluded that sediment distributions do not reflect present-day deposition. The present mixed sediment distribution on the shelf is the result of periods of lower sea level during the Pleistocene period and modified present-day sediment dynamics. Studies show source material derived from the Alaskan mainland, the Aleutian Islands, and the Pribilof ridge. The St. George Basin acts as a sink for the fine grained material.

A more detailed description of the sediments and distribution can be found in the above-mentioned work by Gardner et al. (1979) and by Sharma (1980).

Unstable Sediments: Gardner et al. (1979), using seismic reflection records, determined that the continental slope and rise and the walls of the major submarine canyons, such as the Pribilof and Bering canyons, are regions of potential unstable sediments. Using criteria such as surface faults with

Figure III. A. 1. d.- 1.


100% CLAY
50%
50%
100% SAND
50%
100% SILT
58°
56°
54°
BERING SEA
ST.PAUL I.
PRIBILOF ISLANDS
ST. GEORGE
200
1600
1600
UNIMAK ISLAND
ALASKA PENINSULA
UNIMAK PASS
UNALASKA ISLAND
UMNAK ISLAND
PACIFIC OCEAN
172°
170°
168°
166°
164°
162°

SOURCE: J. V. GARDNER et al , 1979.

Map of lithologic facies of surface sediments from the continental margin.

Figure III. A. 1. d. - 2.

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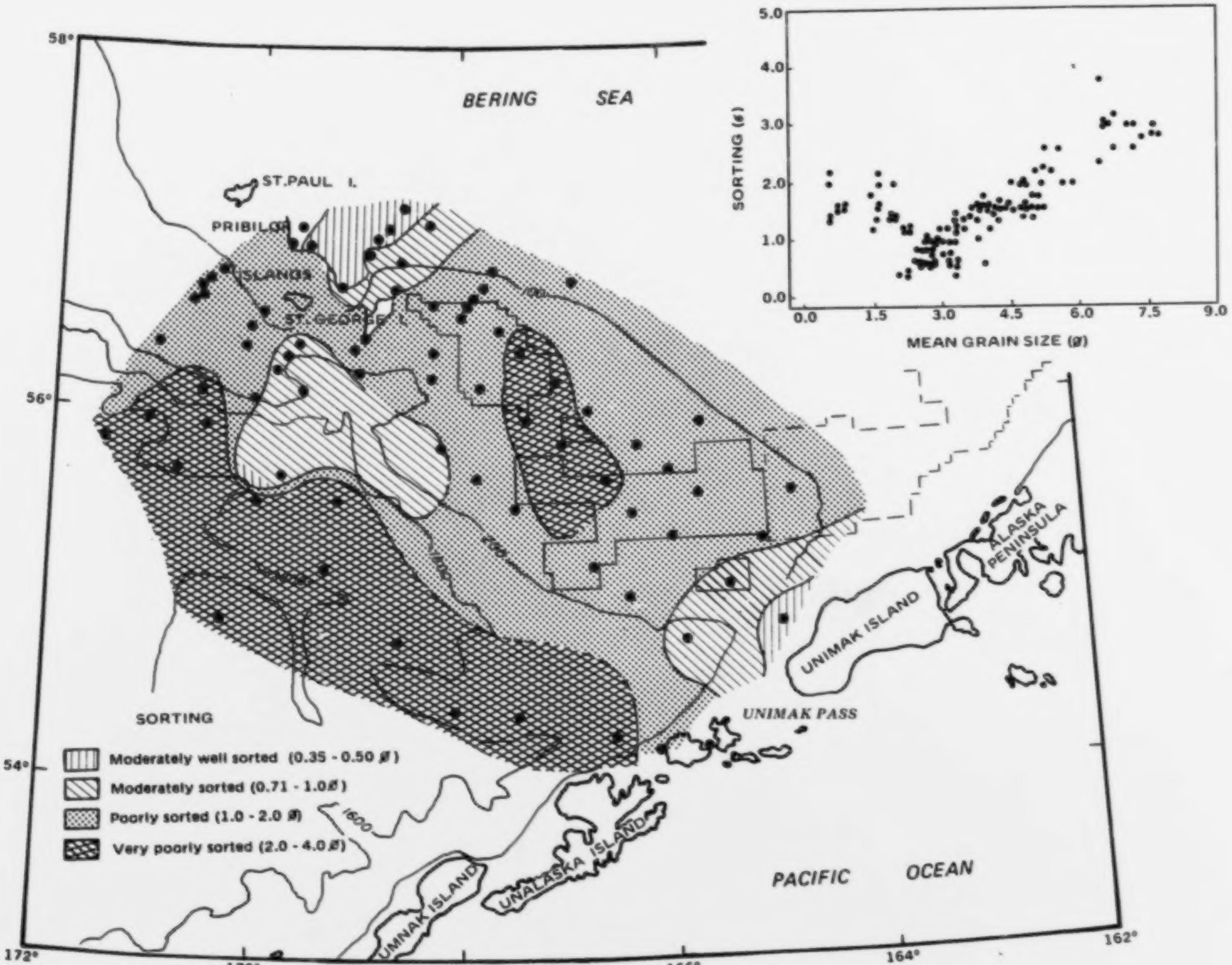
58°
56°
54°
172°
170°
168°
166°
164°
162°
BERING SEA
ST.PAUL I.
PRIBILOF
ISLANDS
ST. GEORGE I.
100
200
1000
1600
UNIMAK PASS
UNIMAK ISLAND
ALASKA PENINSULA
UNALASKA ISLAND
UMNAK ISLAND
PACIFIC OCEAN
SORTING
▥ Moderately well sorted (0.35 - 0.50 Ø)
▧ Moderately sorted (0.71 - 1.0Ø)
▒ Poorly sorted (1.0 - 2.0 Ø)
▩ Very poorly sorted (2.0 - 4.0Ø)
SORTING (Ø)
MEAN GRAIN SIZE (Ø)
0.0
1.0
2.0
3.0
4.0
5.0
0.0
1.5
3.0
4.5
6.0
7.5
9.0

SOURCE: J. V. GARDNER et al, 1979.

Distribution of sorting values from surfaces sediments. Inset is a plot of sorting vs mean grain size.

steep scarps, deformed bedding, hummocky topography, anomalously thick accumulation of sediment, and acoustically-transparent masses of sediment they were able to identify gravity slides, slumps, and zones of creep. Their studies showed that hummocky topography occurs on the continental slope on a large scale, and mass movement is a common feature. Zones of creep were identified near the shelf break at approximately the 170 meter isobath and continued onto the upper slope. Although these potential hazards are located outside the area proposed for the lease sale, they will have to be taken into consideration in selecting any pipeline route through the area.

Gas Charged Sediments: Studies by Gardner et al. (1979) and Kuenvalden and Redden (1979) have shown that small quantities of hydrocarbon gases are present in the surface and near-surface (0-60 cm or 0-23 in depth) sediments of the shelf and slope. The most abundant hydrocarbon present, methane (C_1), showed increased concentration with depth. The other hydrocarbons present showed no such trend. Seismic profiles across the St. George Basin indicate the presence of a number of acoustical anomalies (Graphic 1) at depths of 200 to 300 meters (656-984 ft) that could possibly be the result of gas present in the sediments. However, with the exception of one location, these acoustical anomalies did not produce hydrocarbon gas anomalies in the near surface sediments. The examination of a limited number of cores (Graphic 1) did not indicate that gas seeps are active in the areas sampled or that the concentration of the hydrocarbon gases in the surface or near-surface sediments are a geologic hazard. However, as pointed out by Marlow et al. (1979) these samples are shallow cores that were collected during a wide grid survey and they may not be representative of sediments at greater depths.

The acoustical anomalies may be high concentrations of gases and the lack of resulting gas seeps could be the result of the thick sediments preventing the migration of the gas. At the present time, there is not enough information available to completely evaluate the hazards related to gas charged sediments in the proposed sale area.

Ice: Generally, the vicinity of the St. George Basin is free of ice for the greater part of the year. When the ice edge does advance into the proposed sale area, it usually starts in February and reaches its maximum extent in late April (Brower et al., 1977; Webster, 1979). Graphic 1 shows the probability of the location of the ice edge when it reaches its most southern position during the month of April. During this time, the concentration values are between 3 to 9 tenths and ice thickness can reach from 1 to 5 meters (3-16 ft) in thickness (Brower et al., 1977; Martin and Bauer, 1981; Marlow et al., 1979). It should be noted that during light ice years the most southward advance of the ice may never reach the vicinity of the St. George Basin. During 7 consecutive years of ice observations at St. Paul Island, no ice was reported in 3 of those years (Dames and Moore, 1980).

A more detailed description of the Bering Sea ice pack can be found in Section III.A.2.

2. Meteorological Conditions and Physical Oceanography:

a. Climate and Setting: The blocks which comprise the proposed OCS lease sale 70 in the St. George Basin trend southwest between St.

George Island and the Aleutian Chain. The proposed lease blocks are in 98 to 154 meters (320-505 ft) of water. Climatically, the St. George Basin is classified polar-oceanic (Overland, 1981).

Because of open ocean and prevailing currents, weather in the St. George Basin is less extreme than elsewhere in the eastern Bering Sea. Waters are usually ice-free throughout the year. Incursions of Bering Sea pack ice occur only during parts of February through April in heavy ice years (Wise and Searby, 1977; Webster, 1979). Air temperatures follow oceanic seasons. Mean air temperatures do not drop below freezing until January near the Pribilof Islands and remain above freezing near the Aleutians (Brower et al., 1977). The coldest temperatures occur in February and March.

The dominating physical phenomenon in the Bering Sea is the frequency and seasonal change in position and tracks of storm centers across the Bering Sea and northern Gulf of Alaska. In early autumn, the predominant storm track, the Aleutian low, migrates out of the northern Bering Sea and crosses the Alaska Peninsula. In winter, the low is located, on the average, in the Gulf of Alaska (approximately lat. 55° N., long. 155° W.). This positioning results in fewer storms in the proposed lease area in January and February. Winds at Driftwood Bay in the Aleutians, south of the St. George Basin, that are caused by the location of the winter storm tracks are from the south and southeast. Winds in the Pribilof Islands to the north of the proposed sale area are from the north, northeast, or east (Brower et al., 1977). From October through February, there is an average of two storms per month (per 2° lat., 4° long.) in the St. George Basin. Although the overall frequency of storms is twofold lower than average in the Bering Sea in heavy ice years, as a whole their frequency is 25-percent higher in the St. George Basin (Overland and Pease, 1981). In late winter, the mean center of the Aleutian low moves to the southwest, and in early spring, it moves northward into the northern Bering Sea. In March, this low allows storms to migrate or be guided over the Gulf of Alaska and the Bering Sea increasing the storm frequency in the St. George Basin area (Overland and Pease, 1981). Annual precipitation over the proposed sale area averages between 52 centimeters (21 in) and 62 centimeters (25 in). Precipitation is relatively evenly distributed throughout the year but is more frequent in the northern part of the proposed lease area, falling 33 percent versus 17 percent of the time to the south. Temperatures within the proposed sale area range between -2 degrees C to +1 degree C in February and March to a little over 9 degrees C in August. Observed wind directions are seasonally variable. In the north, they range in the summer from 11 to 17 knots from the southeast through southwest sector and, for the remainder of the year, from 11 to 22 knots from the northeast through northwest sector. Near the Aleutians, winds average 4 to 7 knots from variable directions in summer, 7 to 11 knots the remainder of the year, but from the northwest or southeast in spring and fall, and from the southeast, south, or northwest in winter. Table III.A.2.a.-1 gives the mean annual maximum and minimum temperatures, average annual precipitation, and prevailing surface wind directions, as well as average annual wind speeds for selected sites near the St. George Basin. Tables III.A.2.a.-2 and III.A.2.a.-3 show annual maximum winds and waves, as well as maximum sustained winds for selected return periods, respectively, for the St. George Basin area. Table III.A.2.a.-4 indicates the annual percentage of occurrence of precipitation types in the vicinity of St. George Basin. Visibility is best from October through December; however, even during these months visibility is poor at least 8.5

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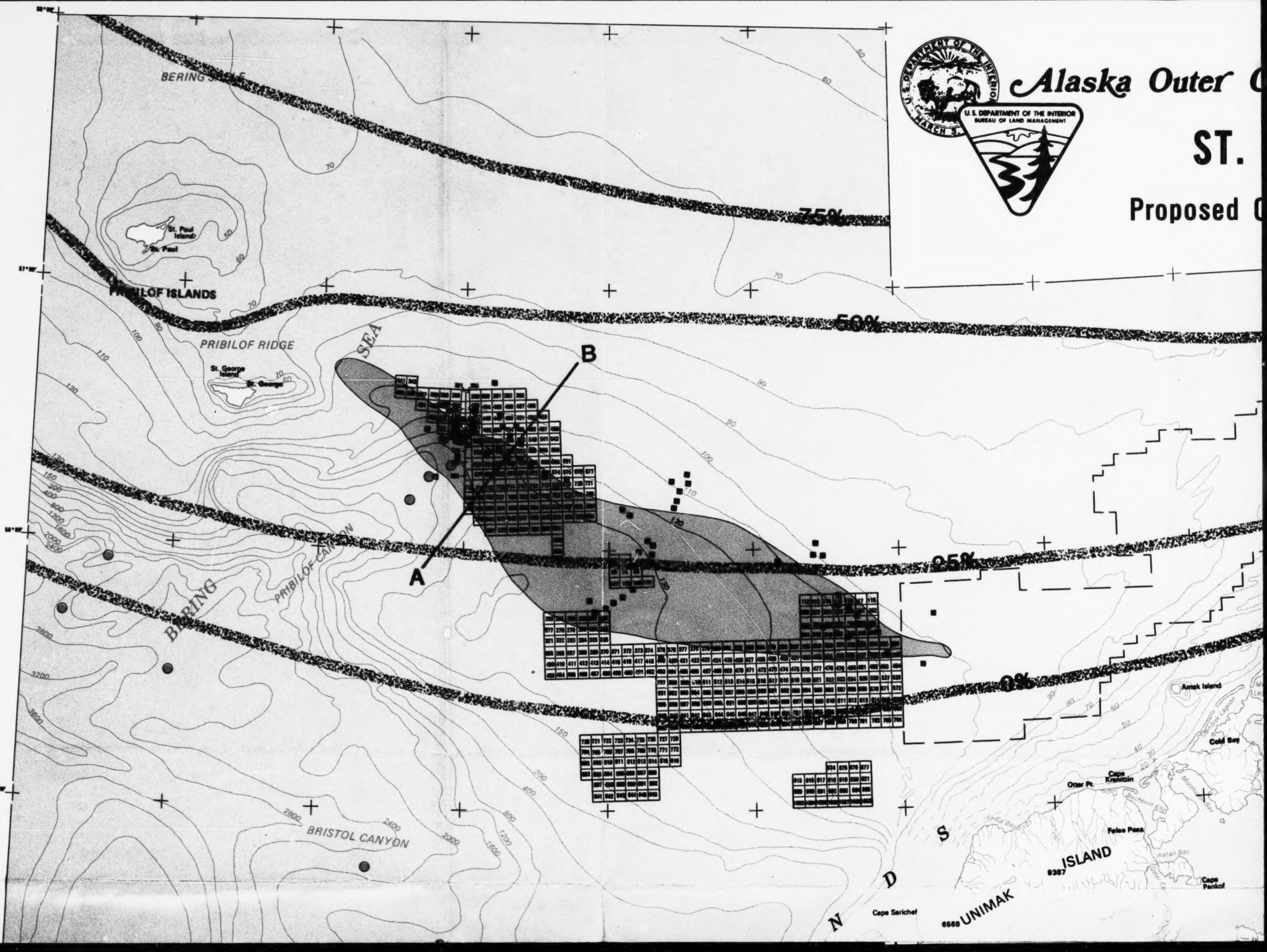
Alaska Outer C

ST.

Proposed C


BERING SHELF
St. Paul Island
St. Paul
PRIBILOF ISLANDS
PRIBILOF RIDGE
St. George Island
St. George
SEA
BERING
PRIBILOF CANYON
BRISTOL CANYON
A
B
75%
50%
25%
0%
Amak Island
Cold Bay
Cape Krenitzin
Otter Pt.
False Pass
Urilia Bay
Ikatan Bay
Cape Pankof
Cape Sarichef
6568 UNIMAK
9387 ISLAND
N
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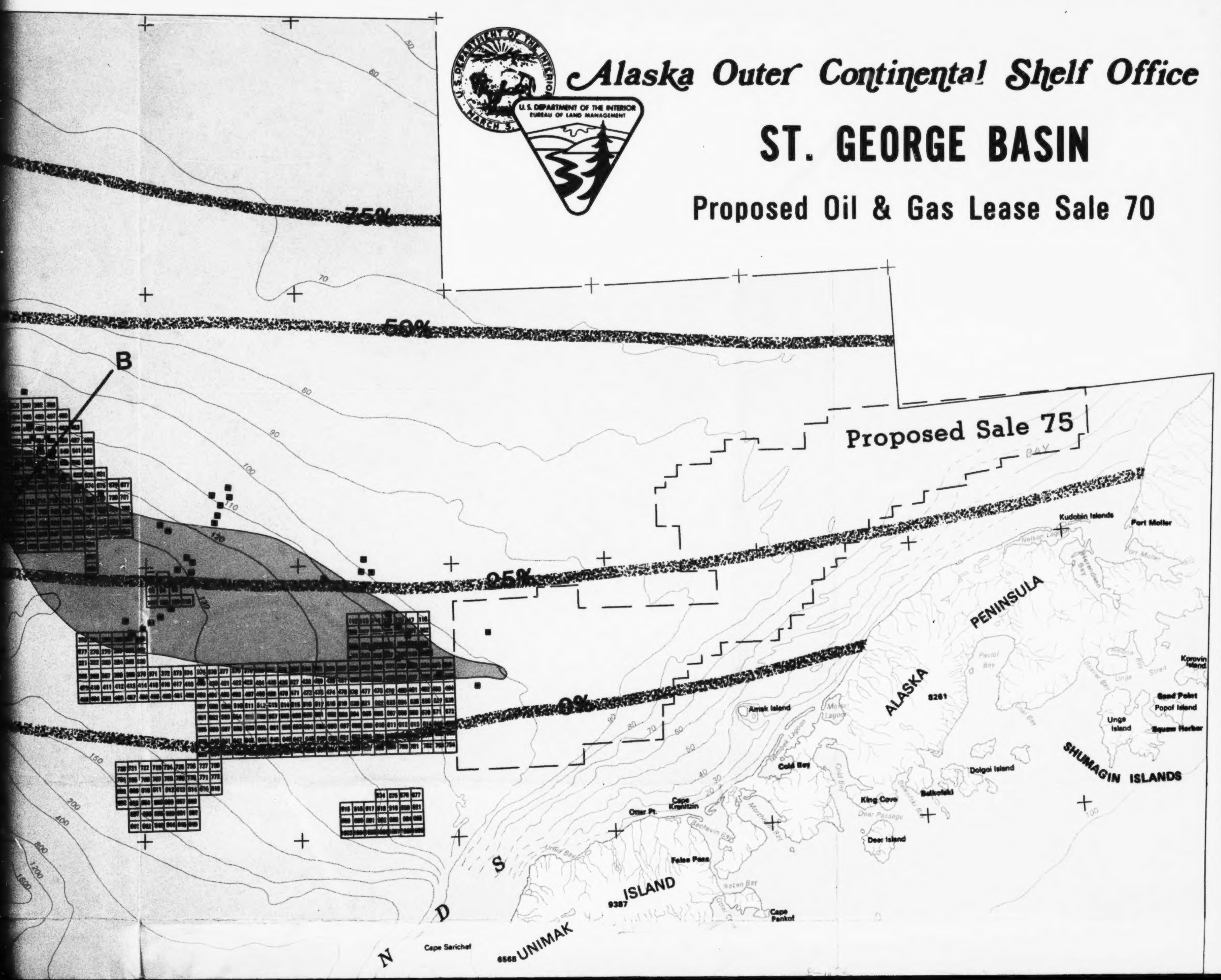
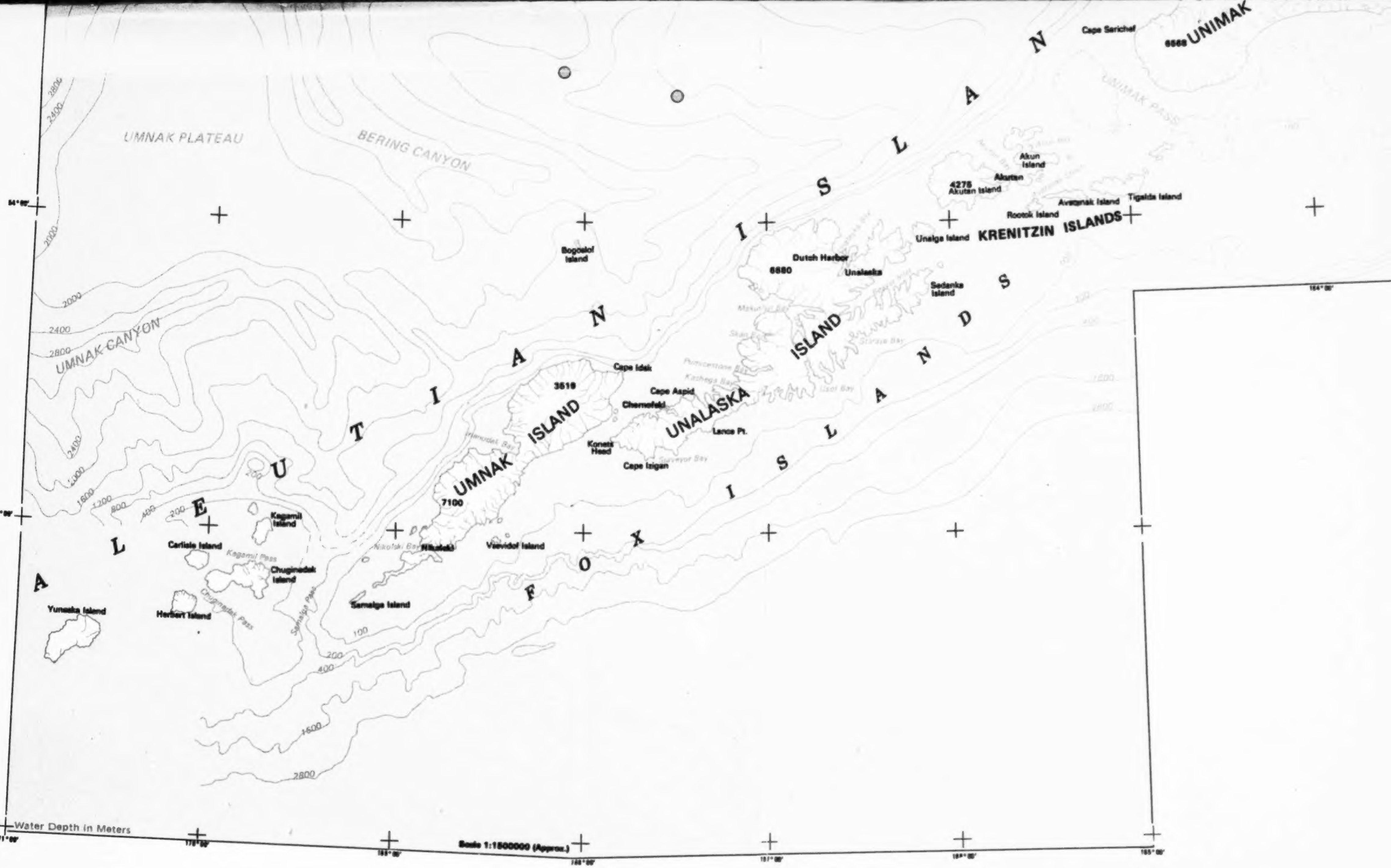
2000
2400
2800
3200
3600

Alaska Outer Continental Shelf Office

ST. GEORGE BASIN

Proposed Oil & Gas Lease Sale 70


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
75%
50%
25%
0%
B
Proposed Sale 75
50
60
70
80
90
100
110
120
150
200
400
800
1200
1600
Kudobin Islands
Port Moller
PENINSULA
ALASKA
8261
Amak Island
Cold Bay
Cape Krenitzin
Otter Pt.
King Cove
Belkofski
Deer Island
Dolgoi Island
SHUMAGIN ISLANDS
Unga Island
Popof Island
Squaw Harbor
Sand Point
Korovin Island
False Pass
Cape Pankof
9387
ISLAND
6568 UNIMAK
Cape Sarichef
N D S


UMNAK PLATEAU
BERING CANYON
UMNAK CANYON
UNIMAK PASS
ALEUTIAN ISLANDS
FOX ISLANDS
KRENITZIN ISLANDS
UMNAK ISLAND
UNALASKA ISLAND
UNIMAK
6868
Cape Sarichef
Akun Island
Akutan
4275
Akutan Island
Avatanak Island
Tigalda Island
Rootok Island
Unalga Island
Bogoslof Island
Dutch Harbor
6880
Unalaska
Sedanka Island
Makushin Bay
Skan Bay
Beaver Bay
Pumicestone Bay
Kashega Bay
Usof Bay
Cape Idak
3519
Cape Aspid
Chernofski
Konets Head
Lance Pt.
Cape Izigan
Surveyor Bay
Inanudak Bay
7100
Nikolski Bay
Nikolski
Vsevidof Island
Samalga Island
Samalga Pass
Kagamil Island
Kagamil Pass
Carlisle Island
Chuginadak Island
Chuginadak Pass
Herbert Island
Yunaska Island
100
200
400
800
1200
1600
2000
2400
2800
54°00'
53°00'
52°00'
171°00'
170°00'
169°00'
168°00'
167°00'
166°00'
165°00'
164°00'
Water Depth in Meters
Scale 1:1500000 (Approx.)

SOURCE: Alaska OCS Office, 1981.
Brower et al, 1977.
Gardner et al, 1979.
Marlow et al, 1979.
Webster B.D., 1979.

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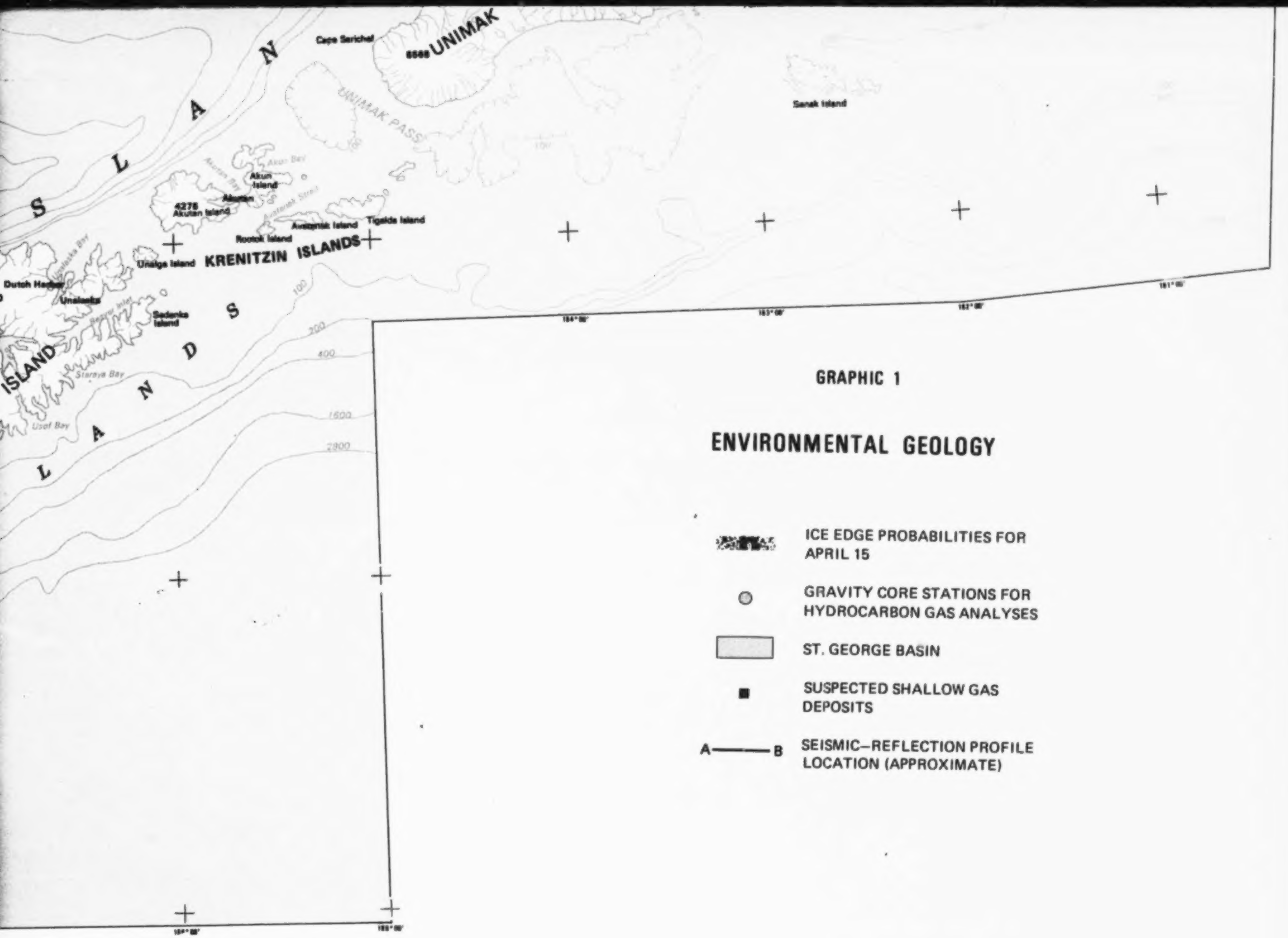
Cape Sarichef
6568 UNIMAK
UNIMAK PASS
Sanak Island
Akun Bay
Akun Island
Akutan
4275 Akutan Island
Avatanak Strait
Rootok Island
Avatanak Island
Tigalda Island
Unalga Island
KRENITZIN ISLANDS
Dutch Harbor
Unalaska
Beaver Inlet
Sedanka Island
ISLAND
Stanaya Bay
Usof Bay
S L A N
S D N A L
100
200
400
1600
2800
164°00'
163°00'
162°00'
161°00'
ICE EDGE PROBABILITIES FOR APRIL 15
GRAVITY CORE STATIONS FOR HYDROCARBON GAS ANALYSES
ST. GEORGE BASIN
SUSPECTED SHALLOW GAS DEPOSITS
A——B SEISMIC–REFLECTION PROFILE LOCATION (APPROXIMATE)

GRAPHIC 1

ENVIRONMENTAL GEOLOGY

64-A

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Table III.A.2.a.-1

Annual Average Weather for Stations in the Vicinity of St. George Basin

	St. Paul Island	Driftwood Bay (Unalaska Island)
Mean Temperature (°C)		
Minimum	-0.8	-0.7
Maximum	3.6	6.3
Precipitation in centimeters (in)	62.3 (24.54)	52.2 (20.55)
Prevailing Surface Wind Direction and Average Speed (Knots)	N 14.9	NW 8.3
Fastest Direction and Speed (Knots)	N 71	WSW 55

Source: Wise and Searby, 1977.

Table III.A.2.a.-2

Annual Maximum Currents and Waves for Selected Return Periods in the St. George Basin

Return Period (yr)	Maximum Sustained Wind (Knots)	Maximum Significant Wave Height in Meters (ft)	Extreme Wave Wave Height in Meters (ft)
5	75	13.5 (44)	24 (78)
10	81	15.0 (49)	27 (89)
25	91	17.5 (58)	31 (104)
50	98	20.0 (65)	35 (117)
100	107	22.5 (73)	40 (131)

Source: Brower et al., 1977.

Table III.A.2.a.-3

Annual Maximum Sustained Winds for St. Paul Island for Selected Return Periods

	Return Period - Years							
	2	5	10	25	50	100	200	1000
Upper Bound (Knots)	52.0	57.9	62.8	70.5	78.0	87.9	101.7	108.7
Wind Estimate (Knots)	50.4	52.2	58.6	63.3	67.0	70.9	75.0	85.4
Lower Bound (Knots)	48.8	52.6	54.8	56.8	57.5	57.1	55.3	43.2

Source: Wise and Searby, 1977.

Table III.A.2.a.-4

Weather Frequency for Stations in the Vicinity of St. George Basin

	St. Paul Island	Driftwood Bay (Unalaska Island)
Precipitation (total percent of time)	32.6	16.9
Rain	18.1	8.9
Freezing Rain	0.2	0.1
Snow/sleet	14.8	7.9
Poor Visibility (total percent of time)	27.6	29.9
Fog	24.6	26.8
Smoke or Haze	0.05	0.4
Blowing Snow	3.0	4.0

Source: Wise and Searby, 1977.

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percent of the time in the north and 19 percent toward the Aleutians because of fog (Brower et al., 1977). Table III.A.2.a.-4 also gives the percent frequency of annual fog, smoke plus haze, and blowing snow in the St. George Basin area.

b. Sea Ice Distribution: The Bering Sea ice pack is of limited importance in the physical oceanography of the St. George Basin. Ice incursions into the area are usually brief, less than 15 days duration, and happen only in February through April (Webster, 1979; Wise and Searby, 1977). Such incursions occur only during heavy ice years, about 1 of every 5 years (see Fig. III.A.1.c.-3). The year-to-year variability in the southern extent of the ice pack has been attributed to a 3 degree C range in annual mean sea surface temperature in the southern Bering Sea (Niebauer, 1981a, b). Very recently, Overland and Pease (1981) have alternatively attributed the extent of ice cover to changes in pattern of fall and winter storm tracks in the Bering Sea. During heavy ice years, there are fewer storms in the Bering Sea; those that occur concentrate over portions of the eastern shelf. The St. George Basin lies within the area with greater frequency of storms in heavy ice years.

Both of the postulated causes of year-to-year variation in ice cover, storm tracts and changes in sea surface temperature are manifestations of longer-than-one-year climatic fluctuations in the North Pacific Ocean. Thus, heavy ice years or light ice years often occur in at least pairs (Niebauer, 1981a; Overland and Pease, 1981).

Most of the ice pack is formed in the northernmost Bering Sea and is advected south by wind stress. The position of the southernmost ice edge is set by the balance of wave action, wind stress, melting, and southern advection of new ice (Overland and Pease, 1981; McNutt, 1981). The ice pack south of St. Lawrence Island is divergent resulting in little ice rafting and relatively thin, only 0.2 to 0.3 meters (0.7-1 ft) thick, (Martin and Bauer, 1981). Recent 1979 studies suggest that the southern ice edge is a melting front (Martin and Bauer, 1981; Pease, 1981). Unfortunately, 1979 was the lightest ice year since at least 1957 (Overland and Pease, 1981) and, therefore, may be atypical. Active ice accretion along the southern front, evidenced by grease and pan ice, occurred in mid-February in 1972 (personal observation, R.T. Prentki, Alaska OCS Office). Thus, both freezing and melting may be important ice edge processes.

Ice edge dynamics are particularly pertinent to OCS development in the St. George Basin. Wave action ice rafts produce thicker floes at the outer edge of the pack. Pack edges contain outer bands of 2 to 5 meters (7-16 ft) which can move downwind 0.2 to 0.4 knots faster than the main pack at higher wind speeds (Martin and Bauer, 1981). In freezing weather, grease and pan ice will damp waves. Both grease ice plumes and ice floe bands can trap and incorporate spilled oil (Martin, 1981).

c. Bathymetry: Depths of the proposed lease sale blocks range from 98 meters (320 ft) in the northeast to a maximum of 154 meters (505 ft) before the shelf break in the southwest. The bottom is featureless in the proposed sale area and slopes gradually toward the southwest.

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d. Hydrographic Characteristics: The vertical and circulation structures of the eastern Bering Sea shelf vary across the shelf but can be used to divide the shelf into three regions (Kinder and Schumacher, 1981a, b). These regions closely correspond to shelf depths of less than 50 meters (160 ft) (inner shelf), depths between 50 to 100 meters (160-330 ft) (middle shelf), and depths between 100 meters (330 ft) and the shelf break (outer shelf). The proposed lease area falls within the outer shelf region and the 27 to 40 nautical mile (50-75 km) wide transition front (Schumacher, 1981) between the outer and middle shelf regions (Fig. III.A.2.d.-1).

There are distinct differences in extent and mode of vertical mixing in the water columns of these regions (Kinder and Schumacher, 1981a). Water depths throughout the outer shelf exceed the sum of thicknesses of the upper, wind-mixed, and bottom tidally-stirred layers, leaving a weakly mixed, mid-depth layer. Water movement tends to be into the outer shelf from both deeper slope and shallower middle shelf. Denser slope water enters the outer shelf region along the bottom and maintains the year-around stratification which occurs only in this part of the shelf. Middle shelf water flows into the outer shelf at mid-depths in 1 to 10 meters (3-33 ft) thick interleavings. Diffusion of salt and heat, however, destablize these thin bands and provide some mixing in the mid-depth layer.

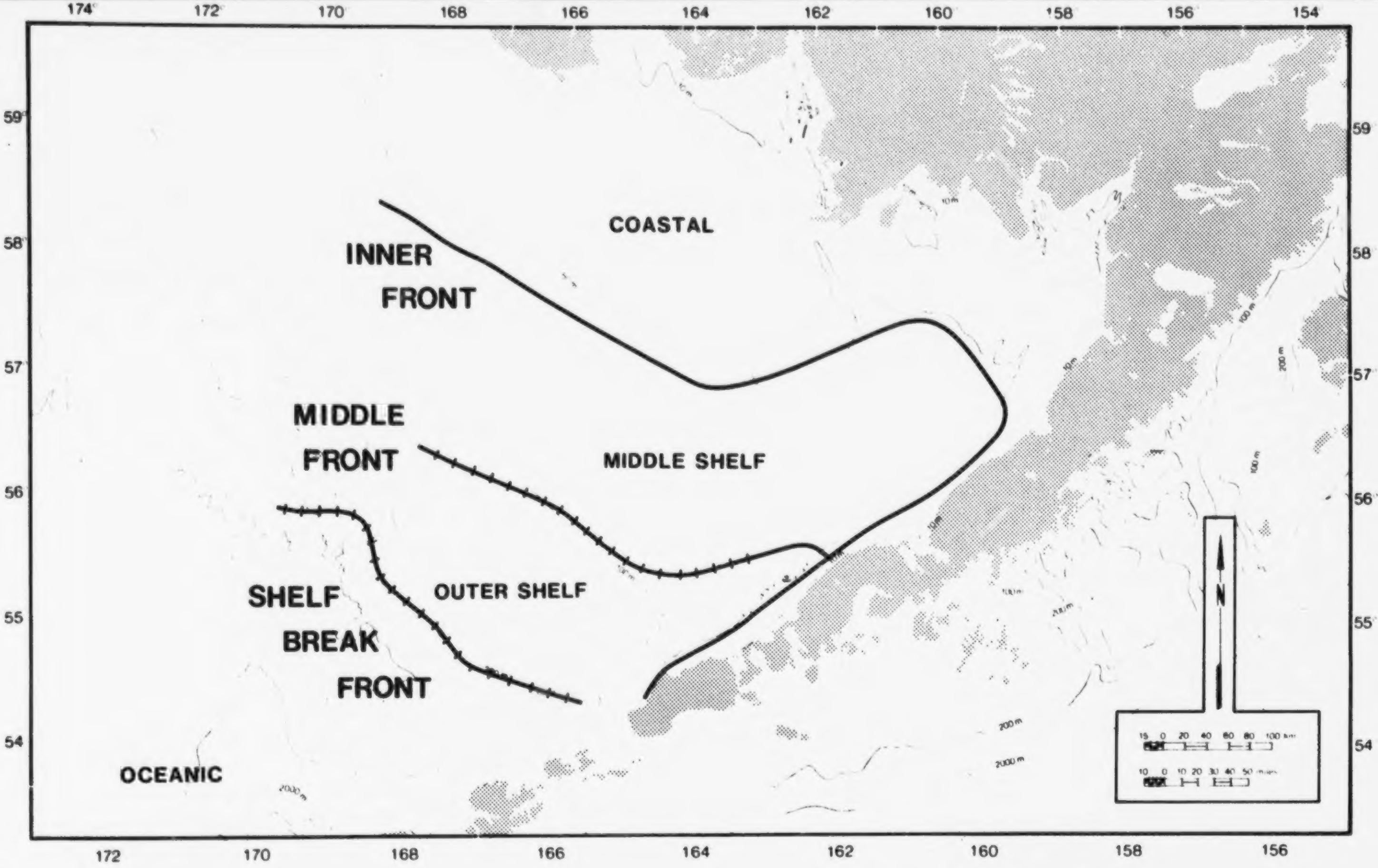
e. Circulation: Currents in the proposed lease area are directed northwest. The eastern Bering Sea has only weak circulation. Tides provide 60 to 80 percent of current energy (Kinder and Schumacher, 1981b). Tidal speeds of 0.2 to 0.6 knots are severalfold faster than net velocities and produce tidal excursions of about 3 to 4 nautical miles (5 to 7 km). Other forcing mechanisms for shelf flow are oceanic currents, baroclinicity (because of density differences), and wind. Wind and other weather phenomena supply 20 to 40 percent of flow energy. Significant seasonal differences in currents do not occur.

Data for currents in the southeastern Bering Sea have been synthesized by Kinder and Schumacher (1981b) and Schumacher (1981); this summary is given in Figure III.A.2.e.-1. For the proposed lease area, there are several relevant features. The 100 meter (330 ft) isobath that traverses the proposed lease area has relatively high current velocities toward the northwest. This current is at least partially driven by convergence on the order of 0.06 knots along the transition front between the outer and middle shelf regions. Beyond the west edge of the proposed lease area, the Bering Slope current also flows northwest but does not appear to enter the outer shelf region. The only across-shelf flow evident is that toward the northeast along the north side of the Alaska Peninsula. This flow, however, is probably intermittent (Kinder and Schumacher, 1981b).

Unimak Pass is flushed tidally with net flow to the north (Schumacher, 1981). This flow peaks at an average of 0.4 knots between March and May. Wind-driven flow reversals occur for up to 2.5 days. Such reversals resulting in flow from the Bering Sea to the North Pacific Ocean occurred in 18 percent of winter and 31 percent of summer observations reported by Schumacher (1981) for 35 hour (non-tidal) records.

f. Tides: Eighty percent of the tidal energy is semi-diurnal and twenty percent is diurnal (Schumacher, 1981). The tidal ellipses formed

Figure III.A.2.d.–1


174
172
170
168
166
164
162
160
158
156
154
59
58
57
56
55
54
COASTAL
INNER FRONT
MIDDLE FRONT
MIDDLE SHELF
OUTER SHELF
SHELF BREAK FRONT
OCEANIC
N
200 m
2000 m
100 m
50 m
172
170
168
166
164
162
160
158
156

APPROXIMATE BOUNDARIES SEPARATING THE THREE SHELF (coastal, middle, outer) AND THE OCEANIC HYDROGRAPHIC REGIONS. THE BOUNDARIES ARE THREE FRONTS: INNER, MIDDLE, AND SHELF BREAK. THESE FRONTS ROUGHLY COINCIDE WITH THE 50 m ISOBATH, THE 100 m ISOBATH, AND THE 200 m ISOBATH (shelf break). REDRAWN FROM KINDER AND SCHUMACHER (1981 a).

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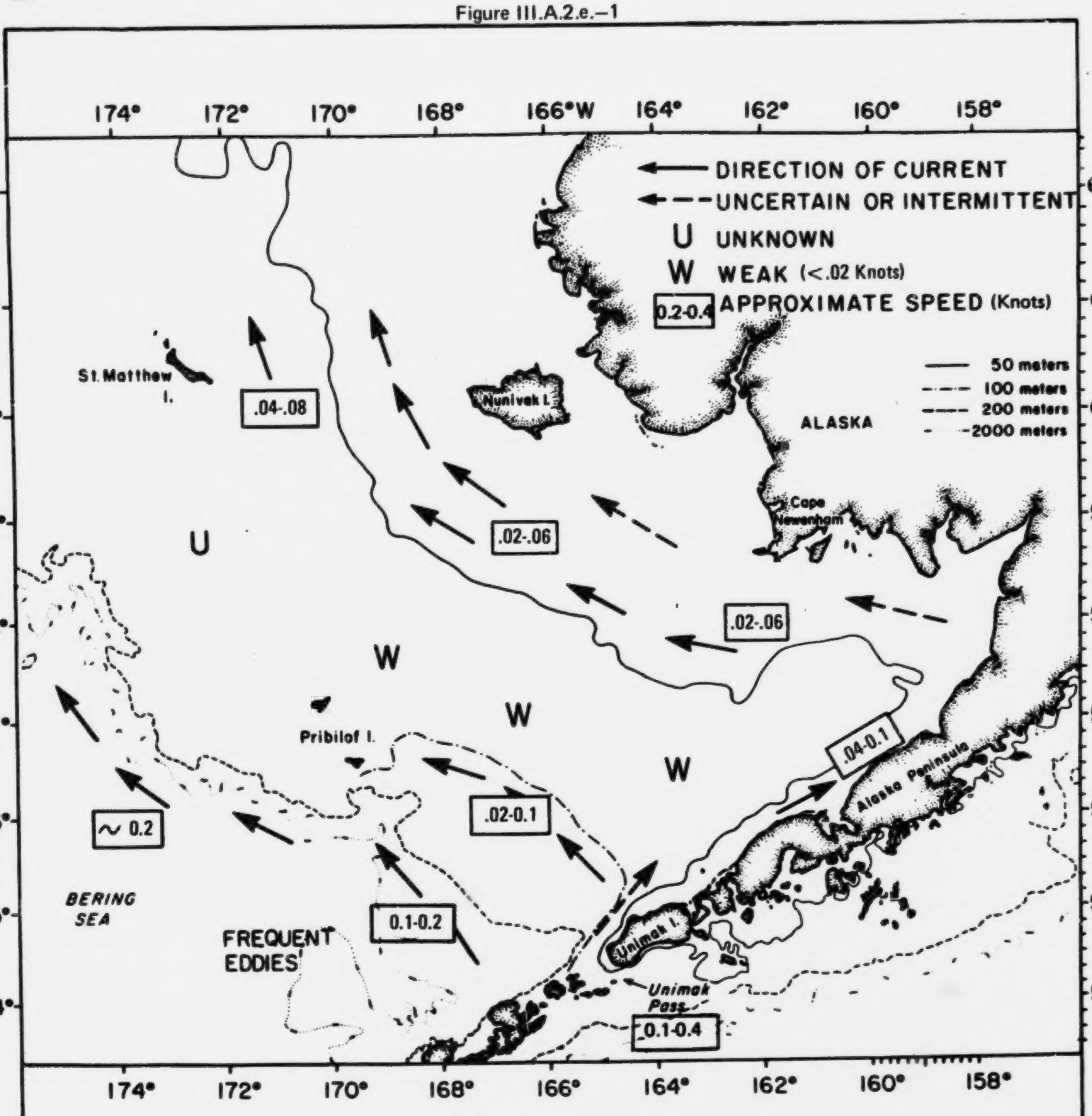
Figure III.A.2.e.–1


174°
172°
170°
168°
166°W
164°
162°
160°
158°
62°
61°
60°
59°
58°
57°
56°
55°
54°
N
DIRECTION OF CURRENT
UNCERTAIN OR INTERMITTENT
U UNKNOWN
W WEAK (<.02 Knots)
0.2-0.4 APPROXIMATE SPEED (Knots)
50 meters
100 meters
200 meters
2000 meters
St. Matthew I.
.04-.08
Nunivak I.
ALASKA
Cape Newenham
U
.02-.06
.02-.06
W
W
W
Pribilof I.
.04-0.1
Alaska Peninsula
~ 0.2
.02-0.1
0.1-0.2
BERING SEA
FREQUENT EDDIES
Unimak I.
Unimak Pass
0.1-0.4

ESTIMATED MEAN CIRCULATION, REDRAWN FROM KINDER AND SCHUMACHER (1981b). THE DASHED ARROWS IN THE NORTHERN COASTAL REGIME EXPRESS UNCERTAINTY, WHILE THE ARROW ALONG THE ALASKA PENINSULA EXPRESSES INTERMITTENCY. Unimak Pass Flow is from Schumacher (1981).

are oriented across-shelf. Within the proposed sale area, tides increase both south and east (Pearson et al., 1981). Tidal height records indicate ranges of 1.0 to 1.2 meters (3.2-4.0 ft) at shores bordering the proposed sale area (Table III.A.2.f.-1).

g. Storm Surges: Reported storm surges in the Bering Sea have run far to the north of the proposed sale area (Wise and Searby, 1977); they do not appear to be common in the St. George Basin.

B. Biological Resources

1. Fisheries:

a. Finfish: About 300 species of marine fishes inhabit the Bering Sea; approximately half of which are benthic and are in shallow or intermediate depths; roughly 10 percent are of commercial value. Pelagic species number about 40. The fishes of the eastern Bering Sea may also be subdivided into two distinct groups, coldwater arctic species and subarctic species, the latter ranging further south into the North Pacific. The fish species of the eastern Bering Sea also constitute an important link in the food chain that supports the many marine birds and mammals that either inhabit or migrate through this ecosystem. This section discusses only the major commercial finfish species. Those not discussed have, in general, similar life histories and vulnerabilities to the impacts of oil and gas development as these major species.

Presently, about 20 species of fish from the eastern Bering Sea are of commercial importance. These are largely bottomfish; however, five species of Pacific salmon and the Pacific herring are also included.

Detailed descriptions of the fisheries resources of the Bering Sea region are contained in various publications by Higgins (1978); Bakkala and Smith (1978); and Pereyra, Reeves, and Bakkala (1975). Interrelationships of these fisheries with some Bering Sea invertebrates are surveyed in a report by Feder and Jewett (1980). The North Pacific Fishery Management Council's Fishery Management Plan for the Groundfish Fishery in the Bering Sea/Aleutian Island Area (November 1979) also contains much valuable fisheries information.

The eastern Bering Sea has supported commercial fishing efforts since the 1860's with four periods identified: (1) a Pacific cod fishery lasting from 1864 to 1950, (2) the beginning of a halibut fishery in 1930, (3) the entry of Asian fishing fleets in the 1930's and more intensively, in the 1950's, and (4) increased crab fishing by the United States and Japan in the 1950's that has continued to the present day. Corollary to these are the historic and present Bristol Bay large scale salmon fishery and a growing herring and herring roe/kelp fishery.

The eastern Bering Sea has been one of the world's long-term and prolific commercial fishing areas. The total catch of fish and shellfish for the recent period 1954 to 1974, are shown in Table III.B.1.a.-1.

South Side Bays: Oil development in the eastern Bering Sea could also influence fisheries on the south Alaska Peninsula as well, where Cold Bay, Ikatan, Morzhovoi, and Pavlof Bays have feasibility as pipeline terminals and tanker

Table III.A.2.f.-1

Diurnal Tidal Range for Stations in the Vicinity of St. George Basin

	Range Meters (ft)		
	Average	Maximum	Minimum
Village Cove (St. Paul Island)	1.0 (3.2)	1.6 (5.1)	0.0 (0.0)
Inanudak Bay (Unmak Island)	1.1 (3.7)	1.8 (5.9)	0.0 (0.0)
Koshega Bay (Unalaska Island)	1.2 (4.0)	1.8 (6.0)	[illegible]
Dutch Harbor (Unalaska Island)	1.1 (3.7)	1.8 (5.9)	0.0 (0.0)

Source: Wise and Searby, 1977.

Table III.B.1.a.-1
Total All-Nation Catch of Groundfish in the Eastern Bering Sea and Aleutian Island Waters
1954-1974[1]

Year	Pollock	Yellowfin Sole[2][3]	Flathead Sole[3]	Rock Sole[3]	Turbot[3]	Halibut	Pacific Cod	Sablefish	Pacific Ocean Perch	Other Fish	Total
1954	---	13	---	---	---	+	---	---	---	---	13
1955	---	15	---	---	---	+	---	---	---	---	15
1956	---	25	---	---	---	+	---	---	---	---	25
1957	---	24	---	---	---	+	---	---	---	---	24
1958	7	44	---	---	---	3	+	+	+	+	54
1959	33	185	---	---	---	5	4	+	+	+	227
1960	26	493	---	---	---	10	6	2	6	10	553
1961	24	610	---	---	---	14	7	26	47	1	729
1962	60	393	---	---	58	15	10	30	20	43	629
1963	112	114	7	3	29	15	14	18	46	6	364
1964	175	93	22	4	62	5	19	6	118	3	507
1965	231	52	6	4	15	4	17	8	127	4	468
1966	263	94	11	8	21	4	19	14	110	7	551
1967	553	153	29	5	24	7	34	16	80	22	923
1968	707	66	27	6	33	6	64	19	84	42	1,054
1969	871	162	19	10	31	6	53	20	56	37	1,265
1970	1,282	119	42	21	18	7	75	14	79	61	1,718
1971	1,761	157	49	42	36	8	50	19	34	56	2,212
1972	1,876	48	14	62	81	5	47	18	41	147	2,339
1973	1,170	79	18	26	51	4	59	10	17	73	2,107
1974[4]	1,554	43	14	20	70	4	65	7	63	87	1,927

[1] Catches for 1954-1963 as reported by Forrester et al. (1974) with the addition of U.S.S.R. catches of yellowfin sole for 1958-1963 (Fadeev, 1970) and Pacific ocean Perch for 1960-1963 (Chikuni, 1975). Catches for 1964-1974 from data provided the United States by Japan since 1964 and by the U.S.S.R. since 1967.

[2] Includes catches of som other flounders up to 1963.

[3] Soviet catches of flounders were prorated by species based on Japanese catches.

[4] Preliminary figures.

Source: Pereyna, W.T., J.E. Reeves, and R.G. Bakkala, 1975.

loading facilities. These bays produce large numbers of salmon and shellfish, principally pink and chum salmon, king, tanner, and dungeness crab, and shrimp. The bottomfish resource for these areas is not at this time utilized nor is data available as to species and numbers. Based on analysis of habitat requirements, these bays are probably important spawning/rearing areas for several bottomfish species; accordingly, any alteration, be it by pollution or even disturbance of adjacent lands, could reduce fishery values to an indeterminate degree.

Demersal Fish:

Yellowfin sole: The yellowfin sole (Limanda asperas) was the most notable commercial bottomfish species of the eastern Bering Sea until it was depleted by foreign fishing fleets in the early 1960's. Currently, the population of this species approximates the size of the original population (Bakkala, 1981), which indicates that the species may have recovered from this over-fishing. The seasonal distribution of adult sole is not well understood; however, the population seems to winter along the slope of the continental shelf between Unimak Island and the Pribilof Islands, while movement is northeastward toward Nunivak and St. Matthew Islands during the summer months. Additionally, the fish seem to exhibit some vertical movement in the water column which occurs during spawning activity and appears to be related to light.

Spawning occurs in the inner shelf region of Bristol Bay. Eggs develop rapidly (about 4 days to hatching, dependent on water temperature). The immature yellowfin sole are also pelagic. Little is known about their survival and feeding habits during their first 2 or 3 years. Former commercial catches of the yellowfin sole ranged from 12,562 metric tons to 553,742 metric tons in the eastern Bering Sea (Table III.B.1.a.-2). Present harvest is less than 100,000 metric tons; the total population is estimated at 2 million metric metric tons (Bakkala, 1981).

Walleye pollock: The walleye pollock (Theragra chalcogramma) is the principal commercial bottomfish species in the eastern Bering Sea. The largest catches are by the Japanese from the grounds between longitude 165° W. and longitude 175° W. (Pruter, 1973). The annual catch from 1970 to 1974 in the Bering Sea/Aleutian Island area has exceeded one million metric tons. This constitutes about 80 percent of the total fish landings from this area. Table III.B.1.a.-3 shows the catch over the period from 1964 to 1979 (Wolotira, 1981).

The commercial fleets find concentrations of pollock along the continental shelf to the Pribilof Islands. Pollock is also found northwest of these islands (Japan Fishery Agency, 1974). Spawning occurs along the shelf from March through July. The pelagic eggs usually occupy near surface waters. The incubation period is inversely proportional to water temperature; colder water increases the time (12 days at 6°-7° C) (Yusa, 1954).

Pollock grow quite rapidly, becoming demersal at lengths of 35 to 50 millimeters (14-20 in) and reaching 90 to 110 millimeters (3.5-4.3 in) in their first year of life (Gorbunova, 1954).

Pacific cod: The earliest Bering Sea commercial fishery was begun by the United States shortly after the 1867 purchase of Alaska, but this fishery was

Table III.B.1.a.-2
Annual Catches of Yellowfin Sole in the Eastern Bering Sea (Longitude 180° E.) and (Latitude of 54° N.) Tons

Year	Japan	USSR	ROK	Others1/	Total
1954	12,562	0	0	--	12,562
1955	14,690	0	0	--	14,690
1956	24,697	0	0	--	24,697
1957	24,145	0	0	--	24,145
1958	39,153	5,000	0	--	44,153
1959	123,121	62,200	0	--	185,321
1960	360,103	96,000	0	--	456,103
1961	399,542	154,200	0	--	553,742
1962	281,103	139,600	0	--	420,703
1963	20,504	65,306	0	--	85,810
1964	48,880	62,297	0	--	111,177
1965	26,039	27,771	0	--	53,810
1966	45,423	56,930	0	--	102,353
1967	60,429	101,799	0	--	162,228
1968	40,834	43,355	--	--	84,189
1969	81,449	85,685	--	--	167,134
1970	59,851	73,228	--	--	133,079
1971	82,179	78,220	--	--	160,399
1972	34,846	13,010	--	--	47,856
1973	75,724	2,516	--	--	78,240
1974	37,947	4,288	--	--	42,235
1975	59,715	4,975	--	--	64,690
1976	52,688	2,908	625	--	56,201
1977	58,090	283	--	--	58,373
1978	62,064	76,300	69	--	138,433
1979 2/	56,824	40,271	1,919	3	99,017
1980 2/	61,295	9,038	16,790	269	87,392

1/ Other nations are Taiwan, Poland, and West Germany.

2/ Preliminary.

Source: Wakabayashi and Bakkala (1978) for catches through 1976; catch data for 1977-79 from data on file, Northwest and Alaska Fisheries Center, Seattle, WA.

Table III.B.1.a.-3
Annual Catches (mt) of Pollock in the Eastern Bering Sea, 1964-79

	Nation					
Year	Japan[1]	U.S.S.R.[2]	R.O.K.[3]	R.O.C.	Poland	Total
1964	174,792					174,792
1965	230,551					230,551
1966	261,678					261,678
1967	550,362					550,362
1968	700,981		1,200			702,181
1969	830,494	27,295	5,000			862,789
1970	1,231,145	20,420	5,000			1,256,555
1971	1,513,923	219,840	10,000			1,743,763
1972	1,651,438	213,896	9,200			1,874,534
1973	1,475,814	280,005	3,100			1,758,919
1974	1,252,777	309,613	26,000			1,588,390
1975	1,136,731	216,567	3,438			1,356,736
1976	913,279	179,212	85,331			1,177,822
1977	868,732	63,467	45,227	944		978,370
1978	821,306	92,714	62,371	3,040		979,424
1979	749,229	58,880	83,658	1,952	20,162	913,881

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[1] From Japan Fisheries Agency (INPFC Areas 1 and 2).

[2] U.S.S.R. trawl fishery longitude 180° E. in the Bering Sea.

[3] Estimates based on U.S. surveillance of R.O.K. fishing activities up to 1976, and reported R.O.K. catches thereafter.

Sources: Alton, M.S. and R. Bakkala, 1976.
Wolotira, R.J., 1981

terminated in 1950. The species is presently taken by foreign fleets. The total average catch for the years 1970 to 1974 was 59,300 metric tons. The largest catches of cod are taken along the continental slope between longitude 165° W. and longitude 175° W. during late fall, winter, and early spring. Pacific cod (Gadus *macrocephalus*) are primarily demersal, the general geographic distribution is similar to that of pollock (Pruter, 1973). Migratory movement of cod is unclear. Los (1974) reports an east/west movement between the continental slope and shelf. The spawning period has not been delineated in the eastern Bering Sea. Based on other areas, it probably occurs during the late winter and early spring. The demersal eggs incubate for 10 to 20 days (Quast, 1969). Larvae habitat is coastal, at depths of 25 to 150 meters (85-495 ft) (Zviagina, 1960).

Pacific Ocean Perch: This rockfish (*Sebastes alutus*) is the most abundant North Pacific rockfish species. Total catch by Japanese and Russian commercial fishing fleets in the eastern Bering Sea from 1960 to 1974 has ranged from 3,700 to 47,000 metric tons, but the upper range has been much lower in recent years.

Unlike other demersal fishes that at least seasonally occur in the shallower waters of the inner continental shelf, the Pacific ocean perch is found at deeper depths (500 m or 1,650 ft) year-round. The larger Bering Sea populations occur near the Pribilof Islands and the southeastern part of the continental slope (Pautov, 1972).

Ocean perch are ovoviviparous, i.e., eggs are fertilized internally and incubated within the ovary. Spawning occurs from March through May. Larvae are planktonic and free-floating for their first year, the only time in their life cycle when they might remotely be susceptible to oil pollution.

Sablefish: Sometimes referred to as blackcod, the sablefish (*Anoplopoma fimbria*) is abundant over the continental slope of the Bering Sea from Unimak Pass to the Siberian Coast (Pruter, 1973). The species is also wide-ranging, with interchange of fish occurring between the Bering Sea, Gulf of Alaska, and off the Pacific Northwest Coast (Sasaki et al., 1975). Sablefish also occupy a wide range of depths: the pelagic eggs and larvae occur in near-surface waters, juveniles in near-surface and inshore waters to depths of about 150 meters (495 ft), and adults in water from 150 to 1,200 meters (495-3960 ft) deep. There are also diurnal vertical movements, upward during daylight and deeper at night. Commercial fishing in the eastern Bering Sea and Aleutian Islands area began in 1958 by Japan and the fishery has expanded rapidly. Table III.B.1.a.-4 shows the landings for the years 1958 to 1974. Sablefish in the Bering Sea spawn in February in deep waters (250-750 m or 825-2,475 ft), however, the planktonic larvae may be carried inshore. Sablefish larvae and schools of juvenile sable fish (less than 40 cm or 16 in) occur nearshore northeast of Unimak Island and the Alaska Peninsula.

Pacific halibut: The Pacific halibut (*Hippoglossus stenolepis*) in the eastern Bering Sea has experienced a dramatic decline during the past 20 years. This is due to overfishing, but also in part to incidental catch of juveniles while trawling for other species. To restore this resource, extensive areas of the eastern Bering Sea have been closed to both halibut fishing as well as trawling for other species. Recent annual trawl surveys have shown an increase in halibut; the protective measure is probably taking effect. Much of the

Table III.B.1.a.-4

Sablefish Landings (mt) by Nations in the Bering Sea and Aleutians, 1958

Year	Bering Sea and Aleutians		
	Japan	USSR	Total
1958	32		32
1959	393		393
1960	1,861		1,861
1961	26,182		26,182
1962	28,521		28,521
1963	18,404		18,404
1964	9,237		9,237
1965	8,600		8,600
1966	13,088		13,088
1967	14,840	274	15,114
1968	16,258	4,256	20,514
1969	18,813	1,579	20,392
1970	10,904	2,874	13,778
1971	14,981	3,000	17,981
1972	16,538	2,406	18,944
1973	9,270	1,254	10,524
1974	7,409	91	7,500

Source: Low et al., 1976.

St. George Basin is important habitat for halibut. Additionally, a growing commercial fishery by inhabitants of the Pribilof Islands indicates numbers of halibut. The Pribilof Islanders catch totaled about 89,000 pounds in 1980 and expansion is planned (personal communication, Larry Merculief, 1981). Table III.B.1.a.-4 lists the Bering Sea halibut catch for the years 1958 to 1975.

Adult halibut occur throughout the southeastern Bering Sea, but commercial quantities are found only in southwestern Bristol Bay on both sides of Unimak Pass. In winter, when inner shelf waters become colder, the fish migrate to and concentrate along the edge of the continental shelf along the 100 fathom (600 ft) contour. With the warming of the water in the summer, halibut move to the shallow water of Bristol Bay and in a northeasterly direction as far as St. Lawrence Island. This seasonal temperature dependent movement of southeastern Bering Sea halibut requires further study. Bering Sea halibut spawn from November through March along the edge of the continental shelf. The pelagic eggs hatch in about 15 days and the larvae are also pelagic for up to 6 months.

Other Flatfish: Flatfishes, other than yellowfin sole and Pacific halibut, are for the most part caught incidental to the expanded pollock fishery. The most important of these species, in terms of recent foreign commercial catches, are arrowtooth flounder or "turbot," rock sole, and flathead sole. Alaska plaice are abundant in Bristol Bay but are not of commercial importance at this time. Starry flounder and longhead dab are also fairly common in the coastal areas but are of little commercial value.

Pacific Salmon: The five species of Pacific salmon indigenous to the eastern Bering Sea and Bristol Bay also inhabit or transit the proposed lease sale area, at least seasonally, both as immatures and adults.

The Bristol Bay sockeye salmon fishery is the largest salmon fishery in the world today. Domestic catches of sockeye have ranged from 0.8 to 24.3 million fish, averaging 7.3 million over the period 1955 to 1974. Sockeye abundance is cyclical and the returns fluctuate widely. Chinook, coho, pink, and chum salmon are also taken, but overall, they are of much less importance than the sockeye.

Salmon fishing extends from May through September depending on species and fishing regulations. The large sockeye fishery peaks in early July. Downstream migrations of fry and smolts occur during spring and early summer, and these smaller fish probably remain inshore until late fall. Both adults and juveniles migrate through the proposed lease sale area and occur in streams on both sides of the Alaska Peninsula westward to the end of the Aleutians. Considerable numbers of Alaska salmon are also intercepted by the Japanese high seas gillnet fishery.

Sockeye: The sockeye salmon (Oncorhynchus nerka), inbound on their spawning migration, are concentrated offshore north and south of the Pribilof Islands (Straty, 1969). Westward of Cape Seniavin, sockeye bound for Bristol Bay are a considerable distance offshore (50 km or 30 mi) (Straty, 1975).

After returning to their natal streams, the adults spawn and die. Fry live for 1 to 2 years in the lake associated with their spawning stream before smolting and migrating to the sea. At sea, the smolt occupy relatively shallow depths, 1 to 2 meters (3.3-6.6 ft), as they move coastwise down the Alaska Peninsula. Considerable numbers rear along the continental shelf (Nishiyama, 1974).

Chinook Salmon: This species (Oncorhynchus tshawytscha) is indigenous to three river systems of inner Bristol Bay and in smaller streams on the north Alaska Peninsula. Chinook are stream spawners and the young rear in these areas for 1 to 2 years before migration to the ocean where they rear for up to 5 years before returning to their home streams. The spawning fish are offshore during May and early June in most areas. Data are lacking for migration routes and rearing areas for Bering Sea chinook salmon; however, based on catches by the Japanese trawl and gill net fisheries, it is probable that these fish range far offshore, at least as adults. Spawning populations migrate through the proposed lease sale area in May. Immature chinook have been taken in the proposed sale area by commercial fishermen while they were trawling for other species.

Chum Salmon: This species (Oncorhynchus keta) ranges along the northern Alaska Peninsula into Bristol Bay. The 20-year (1955-74) annual Bristol Bay catch averages 520,000 fish. Fewer fish are also taken at several areas along the northern end of the peninsula; Bechevin Bay, Izembek and Nelson lagoons, and at Port Moller and Herendeen Bays. The species is also found in the bays on the south Alaska Peninsula under consideration for pipeline terminals and tanker ports.

Chum salmon migrate through the proposed lease sale area and arrive at their natal streams from late June through mid-July. The peak of the spawning run occurs during early July. The chum salmon has limited freshwater residency; the emergent fry rapidly move to the ocean environment where they rear for up to 5 years. Their size on reaching the ocean is variable, as those fry moving downstream for some distance feed enroute and are therefore larger.

Pink Salmon: Pink salmon, (Oncorhynchus gorbuscha), is the second most abundant salmon species of the Bering Sea and Bristol Bay. This abundance varies significantly, however, as even-year catches are much larger than odd-year catches. The average even-year catch in Bristol Bay over the 20 year period, 1955 to 1974, was about 991,000 fish. Pink salmon are found in the proposed lease area both as immatures and adults. They spawn in rivers, and to some extent in inter-tidal zones. The fry move to marine waters shortly after hatching. The species usually remains at sea for 2 years before returning to spawning areas. Pink salmon are also indigenous to possible oil pipeline terminal and tanker port bay areas on the southside of the Alaska Peninsula.

Coho salmon: Bering Sea coho salmon (Oncorhynchus kisutch) are the least abundant of the Pacific salmon in the Bering Sea, except in odd-numbered years when they are more abundant than pink salmon. The average catch over the 20-year period, 1955 to 1974, was about 44,000 fish. Cohoes arrive in August; the spawning run continues through September. The species usually reside in freshwater areas for 1 to 2 years after hatching and then in the ocean for three to five years.

Pacific Herring: The Pacific herring (Clupea harengus pallasi) is one of a group of Bering Sea fishes sometimes referred to as "forage" fishes. The species forms an important link in the food chain for other fishes, marine mammals, and the seabirds of the Bering Sea area. Secondary to this importance is their importance as a commercial and subsistence species. Herring winter in large schools northwest of the Pribilof Islands, passing through the proposed lease sale area during fall and spring.

Eastern Bering Sea herring have been fished commercially, but sporadically, for about 75 years. The nearshore fishery on spawning populations by American fleets has increased greatly during recent years. Pacific herring winter in the deeper waters northwest of the Pribilof Islands, moving to shallower inshore waters of Bristol Bay during early May to spawn. Eggs are deposited on kelp in generally rocky intertidal areas. Hatching time varies with water temperature but averages 15 days from spawning to hatching. The larvae are delicate and subject to environmental influences (Smith, 1976).

Herring are fished by foreign fleets of Japan and the Soviet Union as well as by American fishermen. The focus for the expanding American fishery is on nearshore spawning populations.

Other Fishes: A number of pelagic fishes, presently unharvested, also exist in large numbers in the eastern Bering Sea. These species include several of the smelts (*Osmeridae*), the Pacific sand lance (*Ammodytes hexapterus*), and capelin (*Mallotus villosus*).

According to Jackson and Warner (1976), capelin are common along the north Alaska Peninsula, spawning in June on fine gravel beaches. Capelin have potential for becoming a commercial species, although present market prices are too low for exploitation.

b. *Shellfish*: Major commercial shellfish found in or near the lease area include king crab (three species), tanner crab (two species), and Korean horsehair crab. Shrimp (three species) have been harvested in several bays on the southside of the Alaska Peninsula. Additionally, a Japanese commercial snail fishery (15 species) exists in the eastern Bering Sea generally west and north of the Pribilof Islands.

Crab landings from the Alaska Department of Fish and Game (ADF&G) statistical areas located in or adjacent to the lease area (within 160 km or 100 mi), amounted to 139.6 million pounds of king crab for the 1980-81 season, and 73.6 million pounds of tanner crab for the 1979-80 season (Table III.B.1.b.-1). These landings represent approximately 75 and 60 percent respectively of the statewide king and tanner crab harvest. The total 1980-81 value of crab harvested from this area exceeded 153 million dollars.

Within the the proposed sale area, the fishing effort for all crab species generally occurs east of longitude 166° W. and north of latitude 56° 30' N. (Fig. III.B.1.b.-1).

The indicators of stock abundance show stable trends for the king and Korean horsehair crab. Tanner crab species have shown a slight declining trend during the past few years.

King and tanner crabs and shrimp are harvested in the bays located on the south side of the Alaska Peninsula and Unimak Island. During the 1980-81

Table III.B.1.b.-1
Estimated Landings and Value of Crabs From Areas Associated with the St. George Lease Area

		From Statistical Areas[1]			
		Containing Lease Area		Adjacent to Lease Area[4]	
Species	Season	No[2] lbs.	Ex-vessel[3] value	No[2] lbs.	Ex-vessel[3] value
Red king	1980-81	3.1	2.7	125.8	113.3
Blue king	1980-81	1.2	1.2	9.5	8.9
Tanner (*C. bairdi*)	1979-80	1.6	.8	40.9	21.3
Tanner (*C. opilio*)	1979-80	9.2	2.8	21.9	6.6
Korean hair	1980-81	-	-	.03	.05
Total		15.1	7.5	198.13	150.15

1/ Those statistical areas "containing lease area" have some portion of the lease area within them.

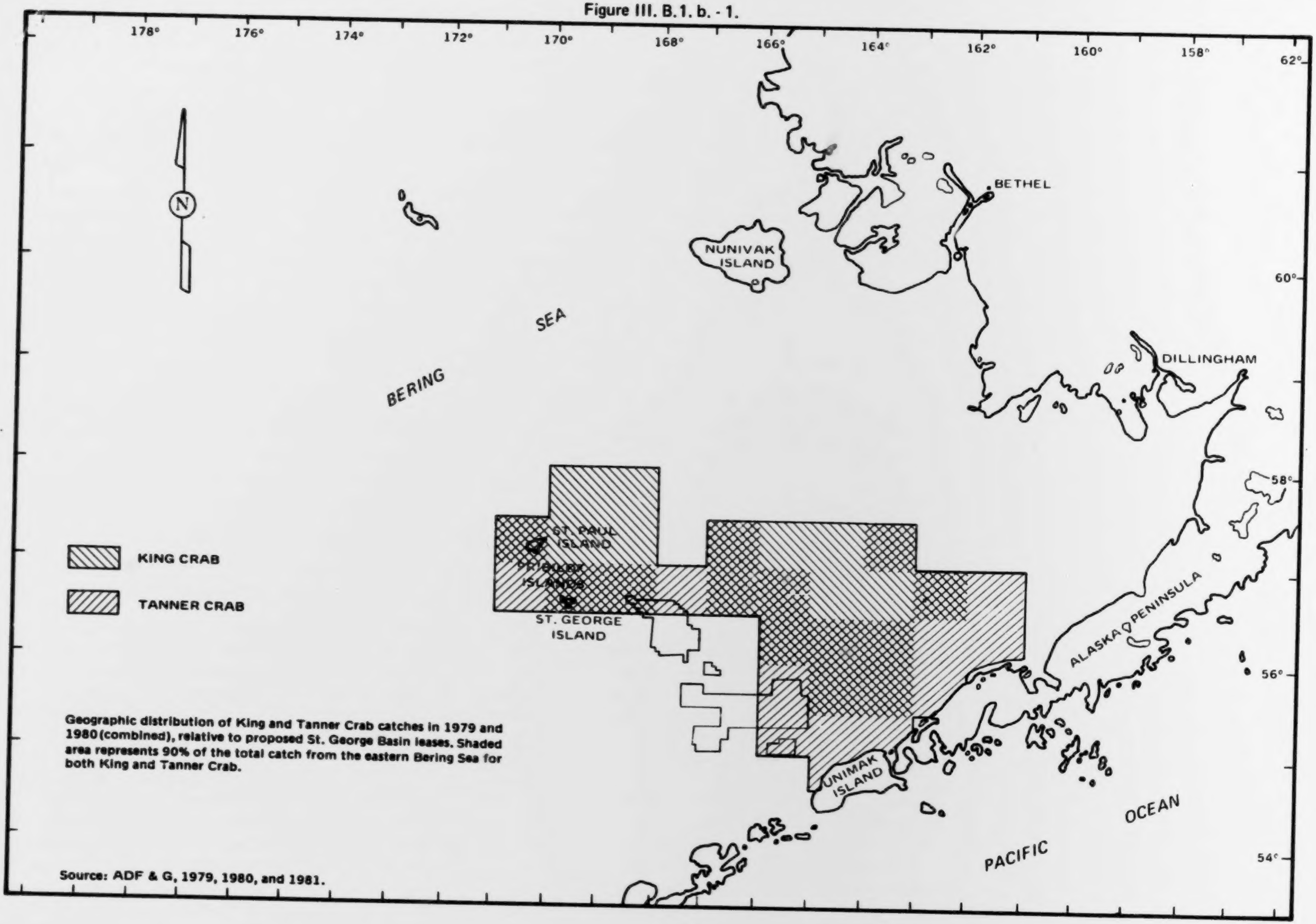
2/ Represented as millions of pounds.

3/ Represented as millions of dollars.

4/ Within 160 kilometers (100 mi) of the lease area.

Sources: Data from ADF&G, 1979, 1980, 1981.

Figure III. B.1. b. - 1.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NUNIVAK ISLAND
SEA
BERING
DILLINGHAM
ST. PAUL ISLAND
PRIBILOF ISLANDS
ST. GEORGE ISLAND
ALASKA PENINSULA
UNIMAK ISLAND
PACIFIC
OCEAN
▧ KING CRAB
▨ TANNER CRAB

Geographic distribution of King and Tanner Crab catches in 1979 and 1980 (combined), relative to proposed St. George Basin leases. Shaded area represents 90% of the total catch from the eastern Bering Sea for both King and Tanner Crab.

Source: ADF & G, 1979, 1980, and 1981.

season, 4.8 million pounds of king crab and 1.9 million pounds of tanner crab were harvested. The 1980-81 season was closed for shrimp. A declining trend is being exhibited by these three fishery stocks in this region.

Shrimp stocks in the eastern Bering Sea have been commercially depressed since 1966, when the Japanese and Soviets terminated their fishery efforts for these species. No information is available on the stock status of the Japanese snail fishery in eastern Bering Sea. A more detailed accounting of shellfish catch information is provided by the ADF&G (1981).

King Crab: There are three commercially important species of king crab in Alaskan waters. These are commonly referred to as red king crab, blue king crab, and golden king crab. The latter is the least abundant with an ill-defined distribution and life history. It enters the commercial catch in limited quantity, and therefore, will not be discussed further. A detailed description of the life history of the former two species has been made by Pereyra et al. (1976) and is summarized below.

The red king crab is the most widespread and abundant of the three species and inhabits the continental shelf in the eastern Bering Sea out to the slope. The general area of maximum abundance extends up to 160 kilometers (100 mi) offshore between Unimak Pass and Port Heiden.

The annual life cycle of the red king crab is dominated by a molting and mating/spawning migration in the spring and a feeding migration in the summer and fall. The spring migration draws adult crabs to the inshore spawning and breeding areas near Amak Island, Black Hills, and Port Moller (Fig. III.B.1.b.-2). During this migration, young adults precede older adults, and males precede females.

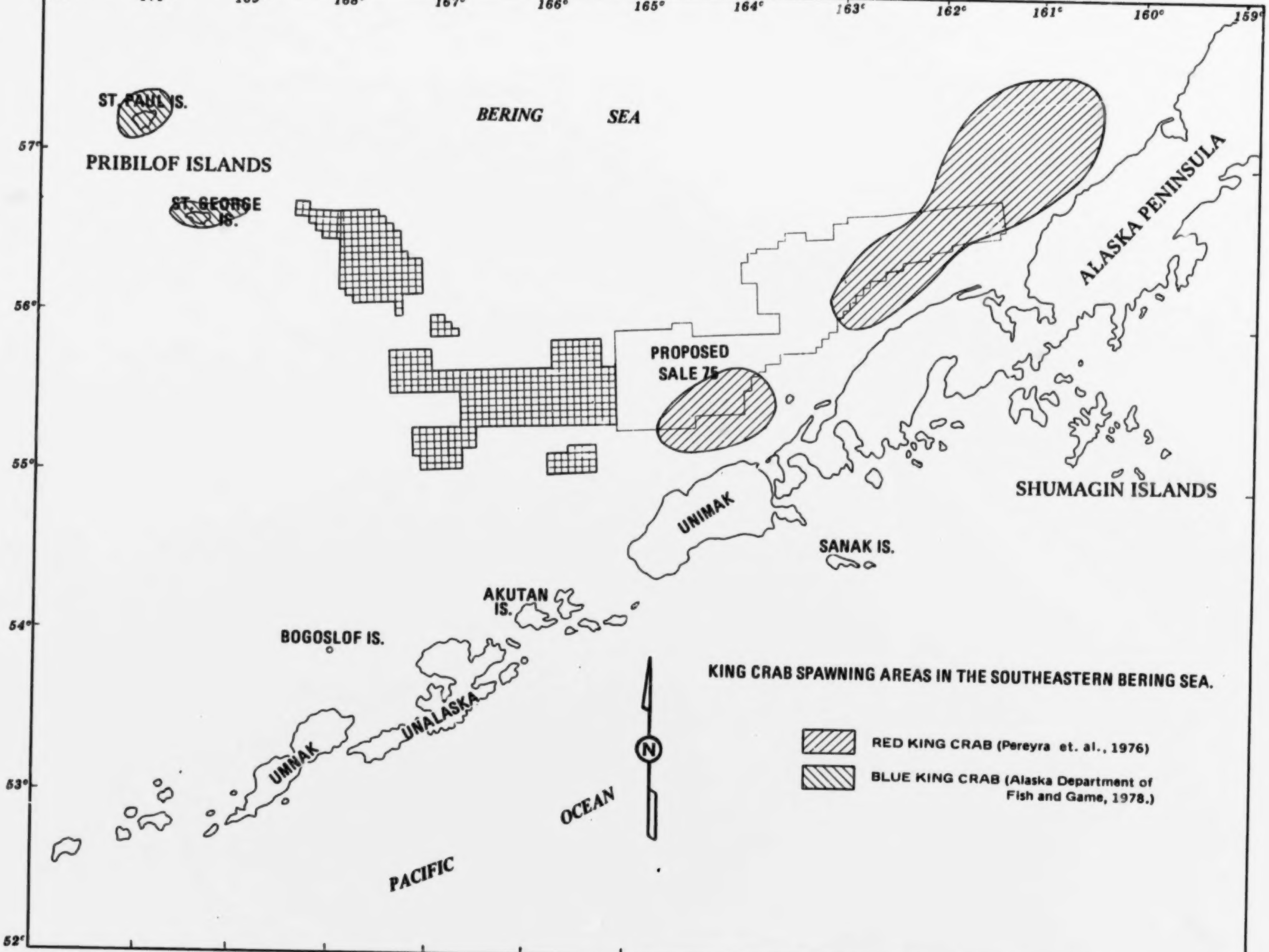
On the spawning grounds, many events occur at the same time. These include hatching of eggs which are carried by the females, and the near simultaneous molting of the adult female and mating with the adult male. The peak of hatching often occurs in early May in Bristol Bay, and in mid-April off Unalaska Island. Takeuchi (1962), however, estimated the spawning season in the southeastern Bering Sea to be from mid-June to mid-July.

Actual mating takes place just prior to the molting of the adult female. It is suggested that the female emits a pheremone or molting hormone which attracts the male. Males, which will not molt during the particular breeding season, make up a majority of the breeding stock. The non-breeding males generally undergo molting and remain in deeper water segregated from the breeding population.

In the summer and fall, the breeding adults migrate offshore and generally segregate by size and sex. Tagging studies have shown that individuals do move and mix randomly which indicates that there is a single population of red king crab in the eastern Bering Sea.

The red king crab begins its development in the egg stage attached to the female. After approximately 11 months, embryonic development has been completed; at which time, the egg hatches and the larvae is released. Larval development is characterized by five stages over about a 10-week period. The larvae exhibit vertical distribution in the water column depending upon their

Figure III. B. 1. b. - 2.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PRIBILOF ISLANDS
ST. GEORGE IS.
BERING SEA
PROPOSED SALE 75
ALASKA PENINSULA
SHUMAGIN ISLANDS
UNIMAK
SANAK IS.
AKUTAN IS.
BOGOSLOF IS.
UNALASKA
UMNAK
PACIFIC OCEAN
N
▨ RED KING CRAB (Pereyra et. al., 1976)
▧ BLUE KING CRAB (Alaska Department of Fish and Game, 1978.)

KING CRAB SPAWNING AREAS IN THE SOUTHEASTERN BERING SEA.

development stage. Usually within minutes of hatching, the larvae molt into the first larval stage and actively swim to the surface. After spending several days near the surface, they molt into the successive stages and sink lower in the column until they become bottom-dwelling glaucothoe larvae, a stage from which the juvenile form emerges. Takeuchi (1962) reports that king crab larvae appear to float to the surface at night and make diurnal vertical movements during the planktonic stages.

The first juvenile stage is about 2 millimeters (.08 in) in length, and those between and about 15 millimeters (.6 in) typically inhabit the littoral zone of open exposed coastal areas. Here they seek protection from currents and predators among the rocks and algae.

Juveniles greater than about 15 millimeters (.6 in) long form large aggregations called pods. Observations of pods from a few to several thousand individuals of both sexes have been made in nearshore areas in Gulf of Alaska waters. Little is known on podding behavior in the Bering Sea population; however, this behavior has been observed in Unalaska Bay from June through August. It is believed that the crab exhibiting this behavior retreat to deeper water as surface temperatures drop during the fall months. There is a tendency for individuals of the same size and age to form pods. Pods of larger crab from 60 to 90 millimeters (2.3-3.5 in) carapace width have been observed, and it appears that this behavior continues through the fourth year of life.

Growth of the crab is achieved through molting. During the first year, the juvenile molts 11 times. During subsequent years, the frequency of molts decreases. Beyond the age of 3 years, molting is generally an annual event with both sexes until the males begin to approach their maximum size. When this occurs, molting in males begins to occur on a biennial or even triennial basis.

Very little information is available on the predation of king crabs; however, it is assumed that there is high mortality during the larval stages due to predation by plankton feeding animals. Tagging studies have shown the natural annual mortality of adults to be about 25 percent.

Larval crab are planktonic feeders, which subsist on phytoplankton and smaller zooplankton. Juvenile and adult crabs are considered bottom foraging omnivores. Diatoms are considered a principal food source for the larval and juvenile forms. Molluscs appear to be the major food item for adults in the Bering Sea. Feder and Jewett (1980) present a more detailed analysis of the food web relationships of red king crab and other crab species.

Little is known concerning the biology of the blue king crab. National Marine Fisheries Service (NMFS) trawl surveys for the years 1975 (Pereyra et al., 1976) and 1980 (NMFS, 1980) show what appears to be a single population distributed in the waters surrounding the Pribilof Islands. Larval concentrations are depicted in Figure III.B.1.b.-2.

Tanner Crab: Two species of tanner crab, *Chionoecetes bairdi* and *C. opilio*, and a hybrid of the two species are known to inhabit the continental shelf of the eastern Bering Sea. Their distribution is widespread over the continental shelf from coastal waters to at least 450 meters (1480 ft). Pereyra et al. (1976) present a detailed discussion of these two species which is summarized below.

Little is known concerning migration and behavior of tanner crabs; however, it is believed that both species exhibit a seasonal movement related to reproduction where both species come together for breeding and then remain separated for the remainder of the year. Additionally, it is believed that young crabs of both sexes congregate by age groups. Upon reaching maturity, males mate and leave the aggregation while the recently mature females remain together throughout their lives.

The time of larval release (spawning) appears to vary by species. The hatching season for *C. bairdi* extends from May through July and possibly into August, while the timing of larval release for C. *opilio* appears to be later. There is no known specific spawning area for tanner crab in the Bering Sea.

The larval life cycle is comprised of two zoeal stages and a megalop stage. The megalop stage is followed by the first juvenile stage.

The first zoeal stage becomes active within a few minutes after hatching and rises to the surface where it swims for a few days before descending. the second zoeal stage inhabits the midwater region before metamorphosing into the megalop stage and settling to the bottom. The reported length of time from hatching to the juvenile stage varies from about 12 to 90 days depending upon water temperature. The frequency of molting for tanner crab is inversely proportional to age, with the juveniles molting several times annually and young adults usually molting annually. Older males that have reached maximum size may molt biennially or even triennially. The puberty molt (attainment of sexual maturity) of the female tanner is believed to be a terminal molt.

Limb regeneration in the tanner crab is almost totally restricted to smaller crabs. Regrowth of limbs appears to take place over several subsequent molts.

The predator-prey relationship of both species of tanner crabs is quite similar to that of other crab species (Feder and Jewett, 1980).

Korean Horsehair Crab: Little is known concerning the biology of the korean horsehair crab. NMFS trawl surveys for 1980 show what appears to be a single population distributed in the waters around the Pribilof Islands.

Shrimp: Of the several species of shrimp that inhabit the eastern Bering Sea, only the pink, humpy, and sidestripe are of commercial importance. The life history of the pink shrimp has been described, and is believed to be similar to the other two species (Pereyra et al., 1976).

Major concentrations of pink shrimp exist in an area northwest of the Pribilof Islands at depths greater than 10 to 100 meters (33-330 ft). Humpy shrimp are found over the continental shelf east of the Pribilof Islands and extend into Bristol Bay. Scattered populations of sidestripe shrimp occupy water deeper than 366 meters (1200 ft) along the continental slope. Commercially important areas on the south side of the Alaska Peninsula include Morzhovoi, Pavlof, and Belkofski Bays.

Research of pink shrimp in Kachemak Bay, Alaska, suggests a diel vertical migration which is related to the pursuit of food (Barr, 1970). However, it is uncertain whether populations of pink shrimp in the Bering Sea exhibit the same behavior.

Adult shrimp spawn in the fall. Actual breeding takes place soon after the female undergoes a pre-breeding molt which provides a specialized exoskeleton for the attachment of eggs. Eggs are carried on the abdominal appendages of the female for about 7 to 8 months before they hatch in the spring. The newly hatched larvae are planktonic and drift passively or swim weakly at midwater depths where they feed on smaller planktonic organisms.

Other Shellfish: Other shellfish of importance include the Pacific razor clam and the Alaskan surf clam. At present, there is no commercial effort for these two species; however, some interest has been expressed. The Alaskan surf clam was considered as one commercial possibility to supplement the reduced Atlantic surf clam landings (Hughes et al., 1977).

Pacific razor clam beaches have been identified along Izembeck Bay (McLean et al., 1977), Port Moller, and Herendeen Bay. Surf clams have been found in abundance along the Alaskan Peninsula from Port Moller to Ugashik Bay in water depths from 24 to 33 meters (78 to 108 ft).

2. Marine and Coastal Birds

Distribution and Abundance: The southeastern Bering Sea, including those coastal areas which may be affected by proposed St. George Basin lease sale activities, the Pribilof Islands, eastern Aleutian (Fox) Islands, and southwestern Alaska Peninsula, contains many of Alaska's most impressive and important marine and coastal bird resources. Over 75 species regularly breed, migrate, or overwinter in this region. A majority of the Pacific Alcidae have their centers of abundance in this region, and two species, the red-legged kittiwake (*Rissa brevirostris*) and whiskered auklet (*Aethia pygmaea*) are endemic to the southern Bering Sea (Gould, 1981).

Two major complexes of seabird breeding colonies are found near the proposed sale area or associated potential support facility sites and transportation routes: the Pribilof Islands, ranked as Alaska's number one colony area (U.S. Fish and Wildlife Service, 1979), with nearest landfall 32 nautical miles northwest of the proposed sale area, and the Fox Islands, lying 62 nautical miles south. Large numbers also are found in the Sandman Reefs-Shumagin Islands area south of the Alaska Peninsula. On the Pribilof Islands, extensive rock cliffs are occupied by fulmars, kittiwakes, and murres. The Fox Islands have extensive turf suitable for burrowing species such as storm petrels and several of the alcids. The Pribilof Islands support about 88 percent of the world population of red-legged kittiwakes and about 92 percent of the known Alaska thick-billed murre population, as well as the world's largest breeding colony of murres. The Fox Islands support about 50 percent of the Alaska population of whiskered auklet and about 45 percent of the Alaska population of tufted puffins.

Of the several species comprising, either singly or in combination, the huge seabird colonies in this region (Graphic 2), those listed on Table III.B.2.-1 are numerically dominant. Overall, fork-tailed storm petrels, thick-billed murres, and tufted puffins are most abundant.

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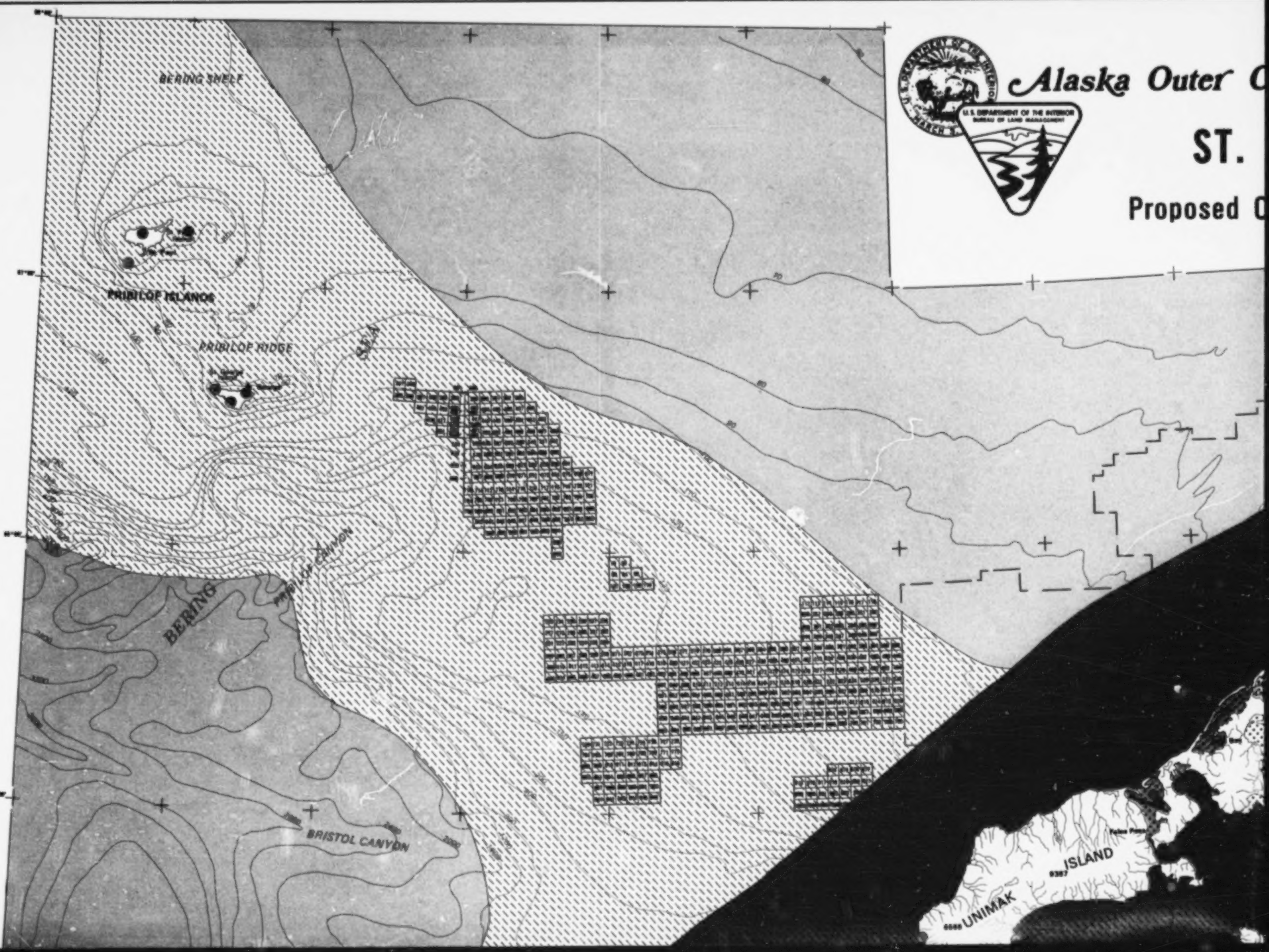
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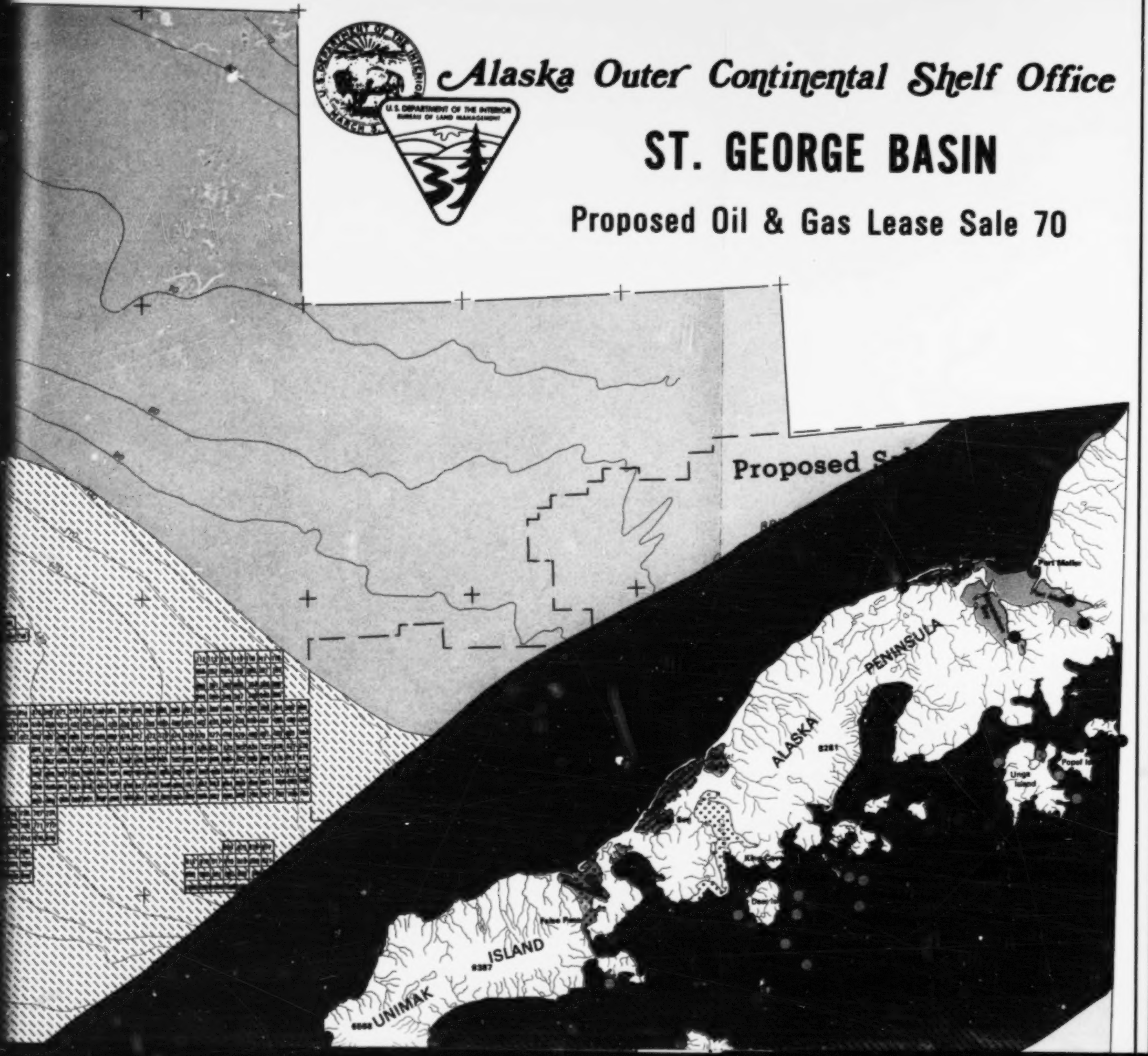
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Alaska Outer Continental Shelf Office

ST. GEORGE BASIN

Proposed Oil & Gas Lease Sale 70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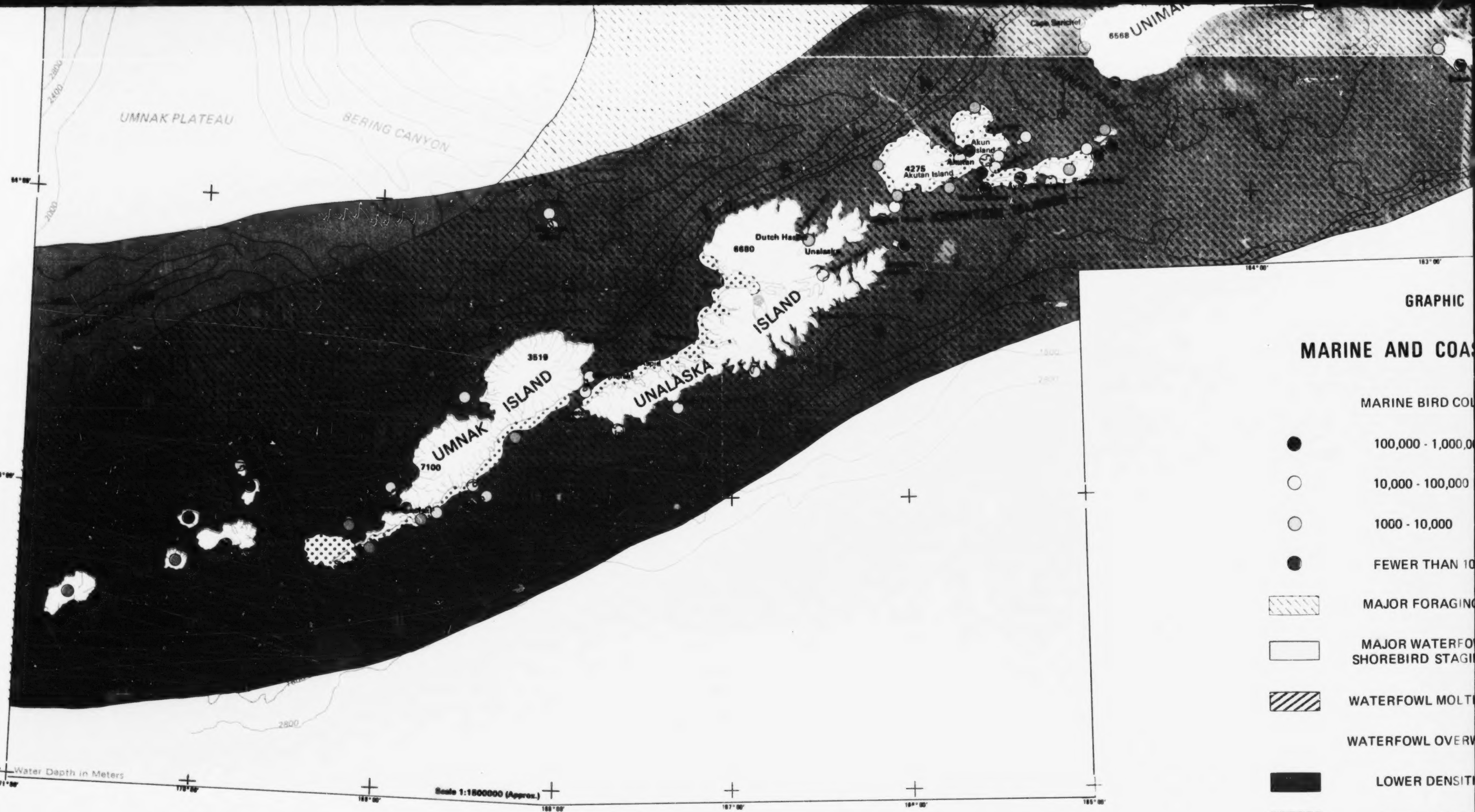
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SOURCE: Arneson, P.D. 1980.
Bellrose, F.C. 1976.
Gill, R., Jr.,C Handel and M. Petersen. 1979.
Hunt, G.L., Jr., P.J. Gould, D.J. Forsell and H.Peterson, Jr. 1981.
Sowls, A.L., S.A. Hatch and C.J. Lensink. 1978.
Trapp. J.L. and D. R. Nysewander. 1981. Personal Communication.

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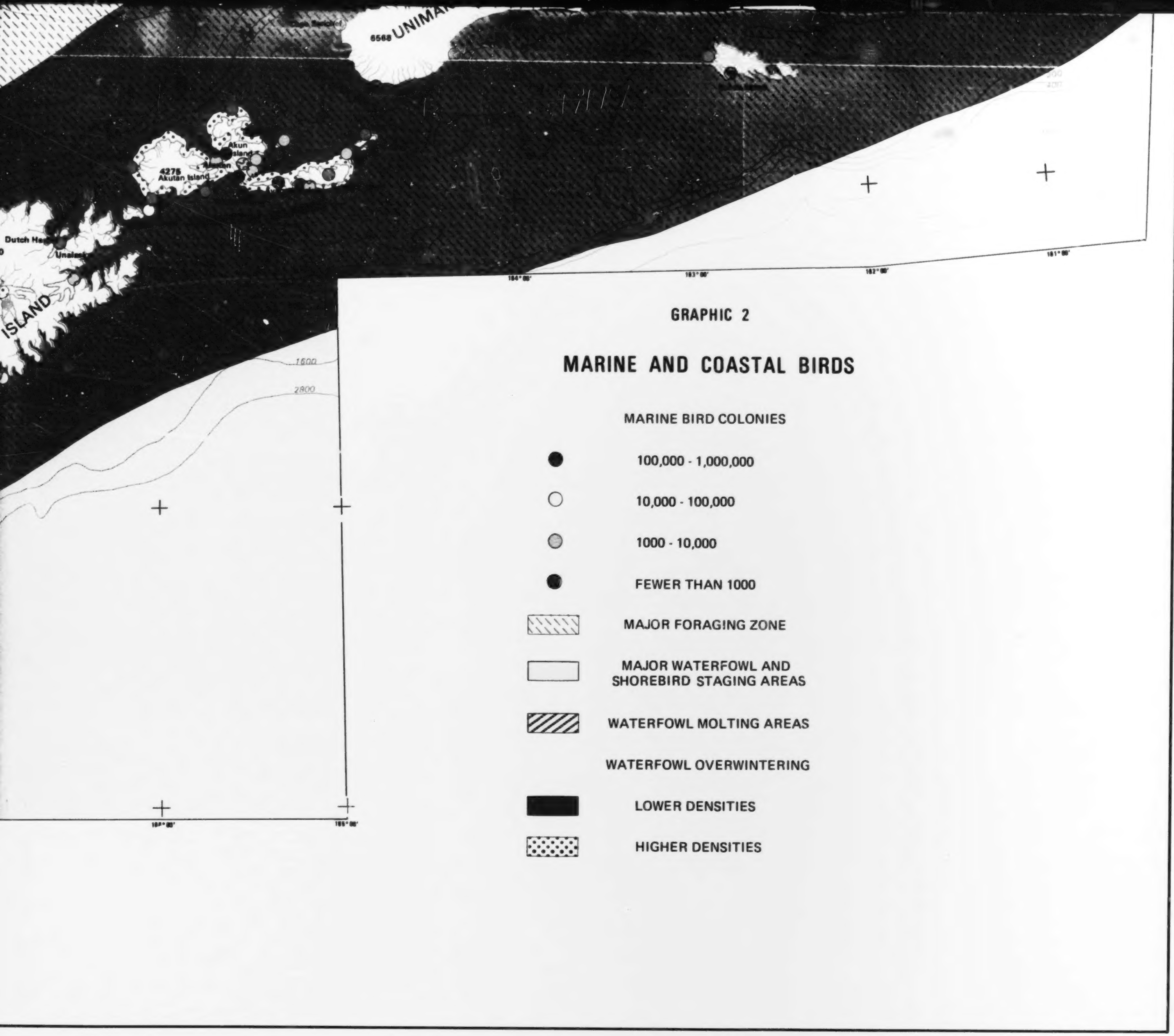

GRAPHIC 2

MARINE AND COASTAL BIRDS

MARINE BIRD COLONIES
● 100,000 - 1,000,000
○ 10,000 - 100,000
◎ 1000 - 10,000
● FEWER THAN 1000
▧ MAJOR FORAGING ZONE
☐ MAJOR WATERFOWL AND SHOREBIRD STAGING AREAS
▨ WATERFOWL MOLTING AREAS
WATERFOWL OVERWINTERING
■ LOWER DENSITIES
▩ HIGHER DENSITIES
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162°00'
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165°00'

Table III.B.2..-1
Estimated Populations of Numerically Dominant Colonial Seabirds in the St. George Basin Proposed Lease Sale Area

Common Name	Scientific Name	Estimated Regional Population
Northern Fulmar	*Fulmarus glacialis*	71,000
Fork-Tailed Storm Petrel	*Oceanodroma furcata*	454,000
Leach's Storm Petrel	*Oceanodroma leucorhoa*	283,000
Glaucous-Winged Gull	*Larus glaucescens*	90,000
Black-Legged Kittiwake	*Rissa tridactyla*	201,000
Red-Legged Kittiwake	*Rissa brevirostris*	222,000
Common Murre	*Uria aalge*	263,000
Thick-Billed Murre	*Uria* lomvia	1,650,000
Murres Unidentified	*Uria* spp.	363,000
Cassin's Auklet	*Ptychoramphus aleuticus*	242,000
Parakeet Auklet	*Cyclorhynchus psittacula*	185,000
Least Auklet	*Aethia* pusilla	273,000
Horned Puffin	*Fratercula corniculata*	242,000
Tufted Puffin	*Lunda* cirrhata	1,580,000

Sources: Sowls et al., 1978; Bailey, Forsell, Gould, and Nysewander, 1981 (personal communications).

The total for all colonial marine birds in this region is 6.07 million (Hickey, 1977; Bailey, 1978; Sowls et al., 1978; Bailey and Faust, 1980; Hunt et al., 1980, 1981; U.S. Fish and Wildlife Service, unpublished data) or about 30 percent of the known Alaska seabird breeding population. Approximately 2.79 million of these (46.0%) nest on the Pribilof Islands while 2.08 million (34.3%) and 1.20 million (19.8%) occupy the eastern Aleutian Islands and Alaska Peninsula, respectively. Estimates for the eastern Aleutian Islands and Alaska Peninsula undoubtedly are conservative since many areas have been incompletely surveyed, particularly for those species which visit their colonies only at night. Recent surveys conducted by the U.S. Fish and Wildlife Service have revealed large numbers of previously unknown colonies (personal communications with Bailey, Forsell, Gould, and Nysewander). Population estimates in Sowls et al. (1978) indicate that Alaskan populations of most species average 43 percent greater than presently recorded.

At present, breeding seabirds occupy approximately 136 colonies or intensively utilized coastal segments in the proposed lease area (Graphic 2). Estimated populations at major colony areas are given in Table III.B.2.-2. Largest concentrations are found on St. George Island in the Pribilofs, Amagat Island outside Morzhovoi Bay, Egg Island east of Unalaska, and the Krenitzin Islands adjoining Unimak Pass.

High densities of seabirds occur over most of the proposed sale area and adjacent waters. Densities of seabirds in the pelagic area are highest in summer and fall when the large numbers of foraging birds from colonies are swelled by vast numbers of southern hemisphere - nesting short-tailed (*Puffinus tenuirostris*) and sooty shearwaters (*P. griseus*) which spend the austral winter in the Bering Sea). Estimates of their abundance vary from 8.7 million (Shuntov, 1972) to 10 million (Sanger and Baird, 1977). Regardless of the precise number, shearwaters are the most abundant species in the Bering Sea from June through September (Hunt et al., 1981). Northern fulmars, storm petrels, and murres also contribute significantly to pelagic densities which range from 15 to over 250 birds per square kilometer (all species combined) in the proposed sale area (Strauch and Hunt et al., 1981).

Although densities of seabirds over the shelf are consistently high during peak seasons, species and flock distributions generally are patchy presumably depending upon food availability and/or location of nesting sites. Peak densities (in excess of 75 birds/km^2), though variable for different species, are found especially surrounding the Pribilof Islands along the outer shelf between the 100 and 200 meter isobaths in Unimak Pass and the eastern Aleutian Islands, and adjacent to both sides of the Alaska Peninsula.

According to Hunt et al. (1981), highest peak season densities are found within 20 kilometers of St. George Island, varying from 431 birds per square kilometer southwest (slopeward) of the island to 530 birds per square kilometer northeast (shelfward). These densities suggest that about 600,000 birds are present in this area at any given moment. High densities also occur in Unimak Pass. In particular, large numbers of shearwaters move between the North Pacific Ocean and the Bering Sea. Huge flocks containing tens to hundreds of thousands of shearwaters are sighted frequently; several flocks estimated to contain one million individuals have been recorded (U.S. Fish and

Table III.B.2.-2
Population Estimates for Major Colony Areas
in the St. George Basin Proposed Lease Sale Area

Colony Area	Location (Lat., Long.)	Estimated Population
Pribilof Islands		
St. George	56° 35' N, 169° 35' W	2,500,000
St. Paul	57° 10' N, 170° 15' W	254,000
Alaska Peninsula (south)		
Amagat Island	54° 54' N, 162° 53" W	451,000
Umga Island	54° 48' N, 162° 43' W	103,000
High Island	54° 49' N, 162° 19' W	135,000
Nigrud group	54° 47' N, 162° 05' W	112,000
Deer Island-Sandman Reefs	54° 47' N, 162° 13' W	168,000
Unga Island	55° 15' N, 160° 40' W	122,000
Eastern Aleutian Islands		
Kagamil Island	53° 00' N, 169° 43' W	287,000
Vsevidof Island	52° 59' N, 168° 28' W	124,000
Ogchul Island	53° 00' N, 168° 24' W	61,000
Kigul Islands	53° 02' N, 168° 27' W	49,000
Bogoslof Island	53° 56' N, 168° 02' W	51,000
Fire Island	53° 57' N, 168° 03' W	42,000
Unalaska Island (southwestern)	53° 18' N, 167° 30' W	135,000
Baby Islands	54° 00' N, 166° 04' W	181,000
Egg Island	53° 52' N, 166° 03' W	627,000
Krenitzin Islands	54° 07' N, 165° 30' W	500,000

Sources: Sowls et al., 1978; Bailey, Forsell, Gould, and Nysewander, 1981 (personal communications)

Wildlife Service, unpublished). Shearwater densities of 354 birds per square kilometer have been recorded in fall, equivalent to about 1.1 million individuals (Gould, 1981), and Arneson (1980) has observed densities from 400 to 1,000 per square kilometer near the southern end of the Alaska Peninsula. During seawatch observations, shearwaters have passed through Unimak Pass at the rate of 600 to 6,000 per minute and murres have traversed the pass at rates of 3,400, 4,804, and 12,000 per hour during migration (Gould, 1981). Mean density of all species in Unimak Pass during summer is 224 birds per square kilometer or about 720,000 individuals (U.S. Fish and Wildlife Service, unpublished).

The area between the 50 and 100 meter isobaths southeast of the proposed sale area consistently contains lower seabird densities than any other region except that beyond the continental slope.

Approximately 50 species of seabirds, shorebirds, and waterfowl regularly utilize coastal habitats of the proposed sale area for overwintering, migration, breeding, molting, or staging. In terms of both numbers and biomass, waterfowl are the dominant group (Gill, 1981). A major proportion of several populations of waterfowl species depend for part of their annual cycles upon comparatively restricted areas along the north side of the Alaska Peninsula (Graphic 2). Species include the black brant (Branta bernicla nigricans) (100% of North American population), emperor goose (Philacte canagica) (90%), Canada goose (Branta canadensis) (60-75%), and Steller's eider (Polysticta stelleri) (100%). Izembek and Nelson Lagoons are the most important areas for geese, dabbling ducks, Steller's eider and several species of shorebirds. Nearby coastal waters are equally important for scoters (Melanitta spp) (50-80%; 108,000) and king eider (Somateria spectabilis) (75%; 375,000-650,000). Heaviest use occurs during spring and fall migratory periods. In April and May, Arneson (1980) recorded 200,000 birds along the north shore of the Alaska Peninsula including about 55,000 black brant, 31,000 emperor geese, 15,500 dabbling ducks, 23,000 Steller's eider and 44,000 gulls. Mean density was 141 birds per square kilometer. Densities were highest in Nelson Lagoon (849 birds/km^2) and Applegate Cove in Izembek Lagoon (358 birds/km^2). Most abundant species in Nelson Lagoon were the emperor goose (388/km^2), sea ducks (233/km^2, 88% Steller's eider), and gulls (208/km^2). In Applegate Cove black brant were most abundant (319/km^2). Arneson (1980) discusses coastal use of waterbird groups in detail. Trapp and Nysewander (personal communication 1981) found coastal areas in the eastern Aleutians supporting substantial numbers of common eider (Somateria mollissima) (1,370+), harlequin duck (Histrionicus histrionicus) (1,022+), bald eagle (Haliaeetus leucocephalus) (117+), peregrine falcon (Falco peregrinus) (16+), black oystercatcher (Haematopus backmani) (562+), and raven (Corvus corax) (557).

In fall, over one million birds have been recorded along the north side of the Alaska Peninsula (Arneson, 1980), including 144,000 Canada geese, 368,000 black brant, 106,000 emperor geese, 54,500 dabbling ducks, 85,000 Steller's eider, 51,000 scoters, 96,000 shorebirds, and 31,000 glaucous-winged gulls (Larus glaucescens). Mean density reported was 453 birds per square kilometer and highest densities occurred in Izembek Lagoon (1,044/km^2), Nelson Lagoon (746/km^2), and Port Moller (618/km^2). In Izembek Lagoon, geese (black brant, Canada goose, emperor goose) were the most abundant birds (932/km^2); in Nelson Lagoon, emperor goose (168/km^2) and seaducks (420/km^2) predominated.

It seems clear that coastal habitats of the north side of the Alaska Peninsula, particularly the shallow lagoon ecosystems, are extremely important as staging and stopover areas for a large proportion of North American populations of black brant, emperor goose, Canada goose, Steller's eider, king eider, black scoter, and several shorebird species during spring and fall migration. Fat reserves replenished during these intervals facilitate the successful completion of migration and prepare the birds for breeding or overwintering phases of the annual cycle.

During winter months, colony-nesting species disperse widely over the southern Bering Sea from the ice front south to the Aleutian Islands and Alaska Peninsula, as well as eastward to the Kodiak Archipelago. With the exception of fulmars, storm petrels, and red-legged kittiwakes, which are most common at the shelfbreak, most birds are found over the continental shelf. The distribution of most species is not uniform but tends to be concentrated in areas of high food availablility such as tide rips, convergence or divergence zones (Pingree et al., 1974), or in the ice front which extends generally from the vicinity of the Pribilof Islands to Port Moller. In the latter zone, Divoky (1981) has found average murre density to be 200 birds per square kilometer, with densities as high as 10,000 per square kilometer not uncommon. Several species of gulls also are frequently encountered, including the ivory gull (Pagophila eburnea) for which the ice front is the only winter habitat utilized in the western arctic. The enhanced productivity of the ice front and adjacent waters also attracts large numbers of overwintering oldsquaw and both common and king eiders (Divoky, 1981; Petersen, personal communication 1981); these species, together with other seaducks, also occupy offshore waters between the ice edge and Aleutian Islands. Substantial numbers of waterfowl also overwinter along both sides of the Alaska Peninsula and in the eastern Aleutians. Approximately 34,000 birds, including 2,000 emperor geese, 4,000 Steller's eider, and 4,500 glaucous-winged gulls, with a mean density of 53 birds per square kilometer, were recorded in the former area by Arneson (1980), while 40,000 birds, including 7,000 emperor geese, 4,000 king eider, 5,500 shorebirds, and 2,500 glaucous-winged gulls, with a mean density of 94 birds per square kilometer (mainly seaducks) were recorded in the eastern Aleutian Islands. Highest densities (3,240 birds/km^2) were recorded at Samalga Island; most abundant in this area were emperor geese (1,435/km^2), seaducks (416/km^2), and shorebirds (1,240/km^2).

In April, alcids move over a broad front to colony areas in the Pribilof and Aleutian Islands, while seaducks and those gulls not nesting in the southern Bering Sea follow the retreating ice northward. In addition to large numbers of resident and migratory marine birds and seaducks, the southern Bering Sea supports millions of southern hemisphere shearwaters which arrive in May to spend the summer months feeding.

On the Alaska Peninsula, large numbers of migratory waterfowl, including black brant, Canada goose, pintail, and various seaducks from southern overwintering areas gather at Izembek, Nelson, and other lagoons to build fat reserves and await opening of the Yukon Delta and other more northern breeding grounds. The breeding population of black brant, about 110,000 birds, remains at Izembek Lagoon until mid-May before moving north to breed. Emperor geese move from their Aleutian and Kodiak wintering areas to gather in the major lagoons on the peninsula's north side prior to departure in late May for the Yukon Delta and beyond (Bellrose, 1976; Gill et al., 1978; Arneson, 1980).

Most of the estimated 200,000 total population of Steller's eiders winter along the southern Alaska Peninsula to Kodiak Island. In spring the eiders gather on the north side of the Alaska Peninsula and remain there until May before continuing northward. Both common and king eiders, as well as alcids and gulls, occupy the area between the ice edge and the Aleutian Islands and the Alaska Peninsula during winter and spring, sharing the more southerly portions with harlequin ducks, scaup, oldsquaw, and scoters.

In addition to the millions of waterfowl which utilize the Alaska Peninsula each migratory period, substantial numbers of migratory shorebirds utilize intertidal and other aquatic habitats in the area prior to moving northward to the breeding grounds.

Summer breeding distribution of colonial marine birds was discussed above and is discussed further by Hunt (1976, 1977), Sowls et al. (1978), Arneson (1980), Hunt et al. (1980), Gould (1981), Hunt et al. (1981). Detailed information about waterfowl can be found in Bellrose (1976) and King and Dau (1981), and information about shorebirds can be found in Gill et al. (1981).

Trophic Relationships: Diet and foraging ecology of marine birds are discussed by Bedard (1969), Ashmole (1971), Cody (1973), Sanger and Baird (1977), Ainley and Sanger (1979), and Hunt et al. (1978, 1980, 1981). Proximity to areas where prey organisms are concentrated by oceanographic conditions strongly influences the distribution as well as the species composition of the outer shelf seabird colonies. Birds nesting on the Pribilof Islands near the shelfbreak have access to a variety of prey species characteristic of relatively shallow shelf waters, oceanic waters, and the shelfbreak zone. In shallow shelf waters, important prey species include walleye pollock (*Theragra chalcogramma*), capelin (*Mallotus villosus*), and amphipods (*Parathemisto* sp.); in oceanic waters, dominant prey species include deep-water myctophid fishes, euphausiids (*Thysanoessa* spp.), calanoid copepods, and squid. Over the shelfbreak, mixing processes and the merger of shelf and oceanic faunas create a diverse and abundant prey community (Hunt et. al., 1980).

Foraging habits of dominant seabird species in the southeastern Bering Sea are shown on Table III.B.2.-3. Most species utilize surface techniques or begin their forays from the surface in relatively shallow waters. Overall, pollock, euphausiids, squid, and amphipods are the dominant food organisms.

Critical foraging areas for Pribilof seabird populations include the area within 50 kilometers of the islands, the shelfbreak to the south and east of St. George Island and the area east of St. Paul Island out to 100 kilometers (Graphic 2).

The numerous seabird colonies of the eastern Aleutian Islands are supported primarily by an abundant food supply concentrated in tide rips which result from strong currents in the passes. Also critical are major lagoons of the north side of the Alaska Peninsula where large numbers of waterfowl replenish fat reserves prior to continued migration in spring and fall. In particular, eel-grass beds in Izembek and Nelson Lagoons are critical to the survival of black brant and emperor goose.

3. *Marine Mammals*: Four non-cetacean species of marine mammals commonly occur in the area which may be affected by proposed St. George Basin

Table III.B.2.-3
Foraging Habits of Selected Seabirds in the Southeastern Bering Sea

Species	Foraging Habits	Food Items	Principal Foraging Locale
Northern Fulmar	Surface Feeding	Squid, Pollock	Far from Colony
Shearwaters	Pursuit-Plunging, Surface-Seizing	Euphausiids, Amphipods Squid	Shelf waters within 50 m isobath
Storm Petrels	Dipping, Surface-Seizing	Squid, Fish, Euphausiids	Seaward of 100 m isobath
Black-Legged Kittiwake	Dipping, Surface-Seizing	Pollock, Myctophids, Capelin, Euphausiids, Amphipods	Between 100 m and 2000 m isobaths (up to 100 km from colony)
Red-Legged Kittiwake	Dipping, Shallow Plunge-Diving	Mytophids, Pollock	Shelfbreak
Murres	Pursuit-Diving from Surface	Pollock, Other Fishes, Invertebrates	Shelf waters (up to 100 km from colonies)
Auklets	Pursuit-Diving from Surface	Euphausiids, Larval Fishes, Polychaete worms, Amphipods, Copepods	Shelf waters near colonies
Puffins	Pursuit-Diving from Surface	Fishes, Invertebrates	Shallow waters near colonies

Sources: Ashmole, 1971; Hunt et al., 1980.

lease sale activities. These are the northern fur seal (*Callorinus ursinus*), Steller (northern) sea lion (*Eumetopias jubatus*), Pacific harbor seal (*Phoca vitulina richardii*) and sea otter (*Enhydra lutris*). In addition, two species of ice-associated seals, the spotted seal (*Phoca vitulina largha*) and ribbon seal (*Phoca fasciata*) are relatively common in northern portions of the area in winter and spring. These species as well as others which may occur sporadically in the proposed sale area are further discussed in Alaska OCS Office Technical Paper No. 5 (Cowles, 1981). Cetaceans and endangered species are discussed in Section III.B.4.

Northern Fur Seal: Most abundant of the pinnipeds occurring in the southeastern Bering Sea and proposed St. George Basin sale area is the northern fur seal. Currently, the North Pacific population is estimated to contain 1.7 million individuals (U.S. Dept. of Commerce, 1980; McAlister, 1981). This includes about 1.22 million (73%) from the Pribilof Islands, 265,000 (15%) from the Commander Islands (USSR), 220,000 (13%) from Robben and Kurile Islands (USSR) and 2,000 (0.1%) from San Miguel Island off California (Fiscus, 1978; Kajimura et al., 1980; U.S. Dept. of Commerce, 1980; McAlister, 1981; Morris, 1981).

Northern fur seals are highly migratory and rarely come ashore during the nonbreeding season, December to May. During this period fur seals lead a pelagic existence with individuals widely dispersed in offshore waters of the North Pacific south of the Aleutian Islands, throughout the Gulf of Alaska, and south to the California-Mexico border. Most individuals are found over the continental shelf and slope from 16 to 161 kilometers (10-100 mi) offshore, most abundantly from 48 to 113 kilometers (30-70 mi) (Baker et al., 1970; Anonymous, 1977). Some mixing of North American and Russian stocks occurs, as evidenced by the Pribilof Islands origin of 12 to 21 percent of 3 and 4 year old males harvested on the Commander Islands (McAlister, 1981).

In general, chronology of the fur seals' return to the breeding grounds reflects the wintering distance of various age classes and whether they will comprise part of the breeding population in a given year. Northward migration of older females from California waters begins in March, and from April to mid-June large numbers of males and females of all ages are found throughout coastal Gulf of Alaska (Kenyon and Wilke, 1953; Swope, 1979). Breeding age males (10 to 15 years old) that overwinter in the southern Bering Sea, south of the Aleutian Islands or in the Gulf of Alaska, are first to return, establishing their territories in late April and May. Older pregnant females arrive starting in mid-June, followed by younger pregnant and nonpregnant females. Younger males, mostly 3 to 5 years old, haul out on areas adjacent to the rookeries in late June, continuing to arrive in descending order of age, into September.

For the first 1 or 2 years, most males and females remain at sea in coastal waters, not returning to the rookeries until they are 2 or 3 years old. Young nonbreeding females, less than 4 years old, arrive from August to October (Kenyon and Wilke, 1953). By August, most nursing females are making trips to pelagic foraging grounds as distant as Unimak Pass, returning periodically to nurse their pups. Males abandon their territories by mid-August to frequent hauling grounds on other parts of the islands or return to sea. Of the approximately 1.22 million seals in the Pribilof Islands population, about 850,000 are found in the Bering Sea/Aleutian Islands area from June to November. Of these, at least 425,000 would be at sea at any given time (McAlister, 1981).

Southward migration for seals of both sexes and all ages begins in October, with peak departure occurring in early November. Females and younger males appear in the eastern Aleutian passes from mid-November to early December and over the continental slope and shelf off southeastern Alaska to Washington in late November and December.

In Alaska, habitats of major importance to fur seals include (Graphic 3): 1) the rookeries and haulout areas of the Pribilof Islands; 2) the continental shelf and slope areas, especially within a radius of 161 kilometers (100 mi) of the Pribilof Islands, but extending as far as 418 kilometers (260 mi) southeastward to the Unimak Pass/Akutan Pass/Unalaska Island area, where females, in particular, forage during the breeding season (Harry and Hartley, 1980); 3) a broad corridor extending from the islands southeastward along the outer shelf and slope to the eastern Aleutian Passes, utilized during migration as well as during the breeding season by foraging females and nonbreeders of both sexes (Harry and Hartley, 1980); 4) Unimak Pass, together with several other eastern Aleutian passes, utilized as major migratory routes especially in spring and fall; 5) the highly productive foraging areas of the continental shelf and slope in the Gulf of Alaska and North Pacific from the eastern Aleutians to southeast Alaska.

In the Pribilof Islands population, over 90 percent of the females between the ages of 7 and 16 are pregnant each year (York, 1980), giving birth to a single pup generally within 2 days of their arrival at the rookery and mating soon thereafter. Early July is the peak of pupping. Number of pups born averages 320,000 annually with an average pup mortality at the rookeries of 8 percent (McAlister, 1981). Pups are fed for 3 to 4 days at about 9 to 12 day intervals following the return of females from pelagic foraging trips. Females feed only their own pups, continuing to nurse them for 3 to 4 months (Bartholomew, 1959). Pups normally venture into the water for the first time when about 4 weeks old, gradually increasing their stay there through the remainder of the season (U.S. Dept. of Commerce, 1977).

Fur seals tend to congregate in areas where nutrient upwelling results in an abundant food supply, such as over the shelfbreak and outer continental shelf, feeding mainly at night and in early morning on various schooling fishes which ascend to the upper water layers to feed during these periods. During migration, foraging seals also congregate on offshore banks such as Portlock and Albatross Banks east of Kodiak Island. In the Bering Sea, from June to November, important prey species include walleye pollock (*Theragra chalcogramma*), squid (Gonatidae), capelin (*Mallotus villosus*), Pacific herring (*Clupea harengus pallasi*), Atka mackerel (*Pleurogrammus monopterygius*) and Bathylagid smelt (Harry and Hartley, 1980; McAlister, 1981), the relative importance varying with season and location. The first three comprise over 80 percent of the total prey taken. Principal competitors for these prey species are presumed to be Steller sea lion, man, and several species of marine birds.

The northern fur seal has been managed since 1911 under the Treaty for Preservation and Protection of Fur Seals, and the Interim Convention of Conservation of North Pacific Fur Seals (1957) with Canada, Japan and the Soviet Union. Annual harvest now averages about 30,000 animals (Kozloff, 1979), or about 10 percent of the annual pup production. Nearly all are 2 to 5 year old males. At present, pup production is slightly below the level which would result in the maximum sustainable yield for the population; however, the long-term program of managing the northern fur seal population certainly represents an outstanding achievement in wildlife management.

Steller Sea Lion: Steller sea lions occur over the continental shelf from California north to the Gulf of Alaska, west through the Aleutian Islands and Bering Sea to the Commander Islands and Sea of Okhotsk, and south to Japan. In summer they range as far north as St. Lawrence Island (McAlister, 1981). Current estimates place the total population between 250,000 and 325,000 individuals (Mate, 1976) with about 200,000 inhabiting Alaskan waters (Braham et al., 1980). Approximately 40 percent (100,000-130,000) of the total population resides in the Bering Sea and Aleutian Islands (McAlister, 1981).

Sea lions generally utilize well defined breeding and haulout areas throughout their range. Sixty-two regularly used rookeries and haulout sites have been identified and censused in the area covered by Graphic 3 (Kenyon and Rice, 1961; Alaska Department of Fish and Game, 1973; Braham et al., 1977a; Calkins and and Pitcher, 1977, 1978, 1979; Braham et al., 1980). However, apparently many of these are subject to change in use patterns since areas previously identified as haulout sites are now considered only as stopover areas (Calkins and Pitcher, 1977). Comparison of site-specific population estimates from the eastern Aleutians and northern Alaska Peninsula made between 1957 and 1968 with counts made from 1975 to 1977 indicates that approximately a 50 percent population decline occurred (Braham et al., 1980). The cause of this decline is unknown, but these authors suggest a combination of factors which may be responsible.

Sixteen rookeries have been identified in the eastern Aleutian Islands, southwestern Alaska Peninsula and Pribilof Islands (Table III.B.3.-1, Graphic 3). Many of the rookeries are used as haulout areas throughout the rest of the year and nonbreeding individuals may occupy haulout areas on these same islands during the breeding season. The Pribilof Islands, as well as many of the Aleutian and Alaska Peninsula areas indicated on Graphic 3 are occupied year-round with greatest numbers occurring between May and October during breeding and molting seasons (Gusey, 1979).

Sea lions are not noted for undertaking well defined migrations in the Bering Sea. However, in late summer and early fall a thousand or more individuals, probably adult and subadult males, regularly reach St. Lawrence Island. Several hundred sea lions also occupy St. Matthew and Hall Islands during late summer, moving south with the advance of ice in fall. Many of the individuals that have been reported as migrating probably were just foraging at sea, although there is a definite dispersal from rookeries following the breeding season. An estimated 40 percent of the population is at sea at any time during the summer, 50 percent in winter (McAlister, 1981). Most sea lions are thought to move south to the Aleutians in winter, although some haul out on floes near the ice front, especially during March and April of years when pack ice intrudes into the St. George Basin area (Braham and Dahlheim, 1981).

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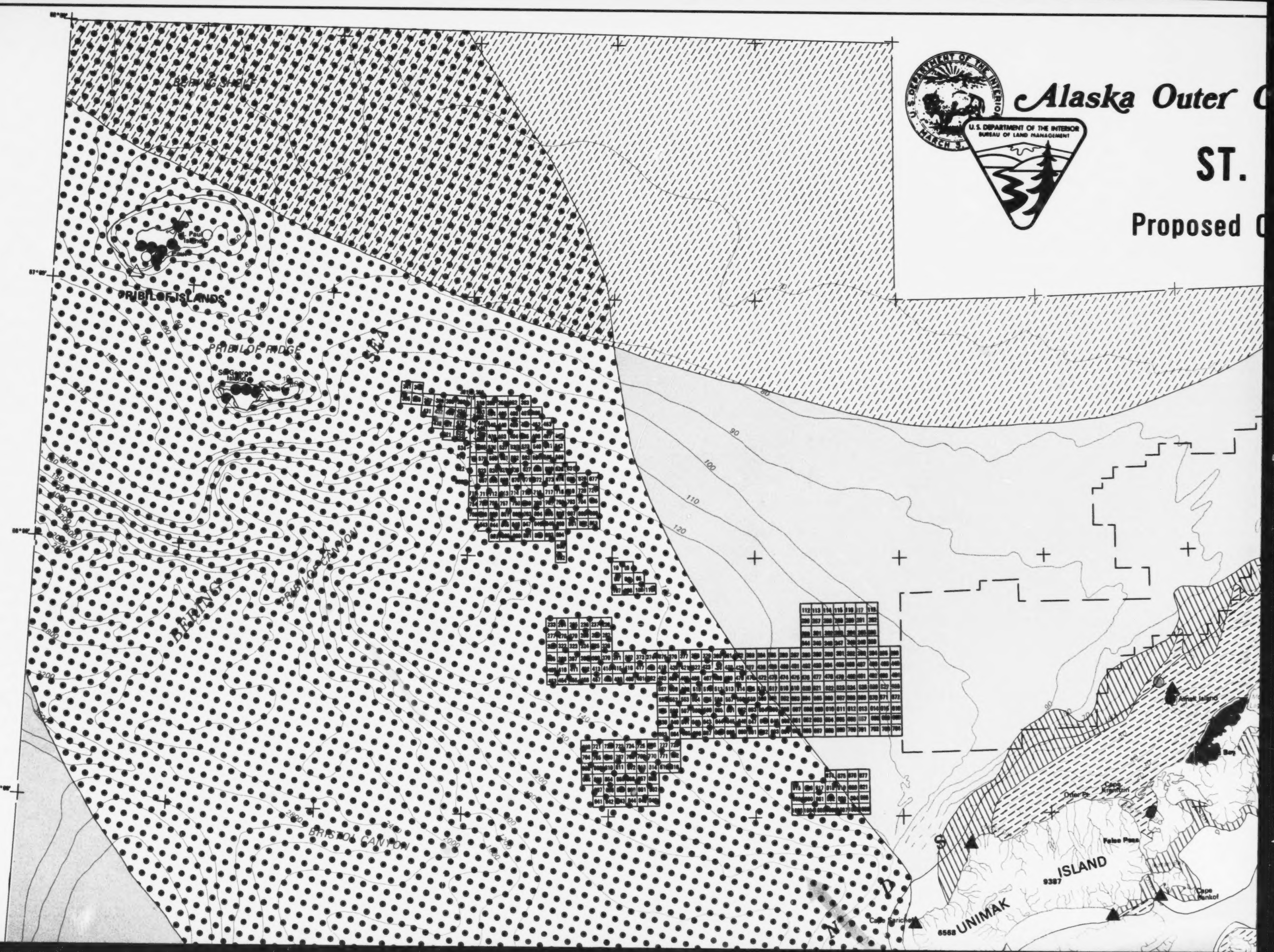
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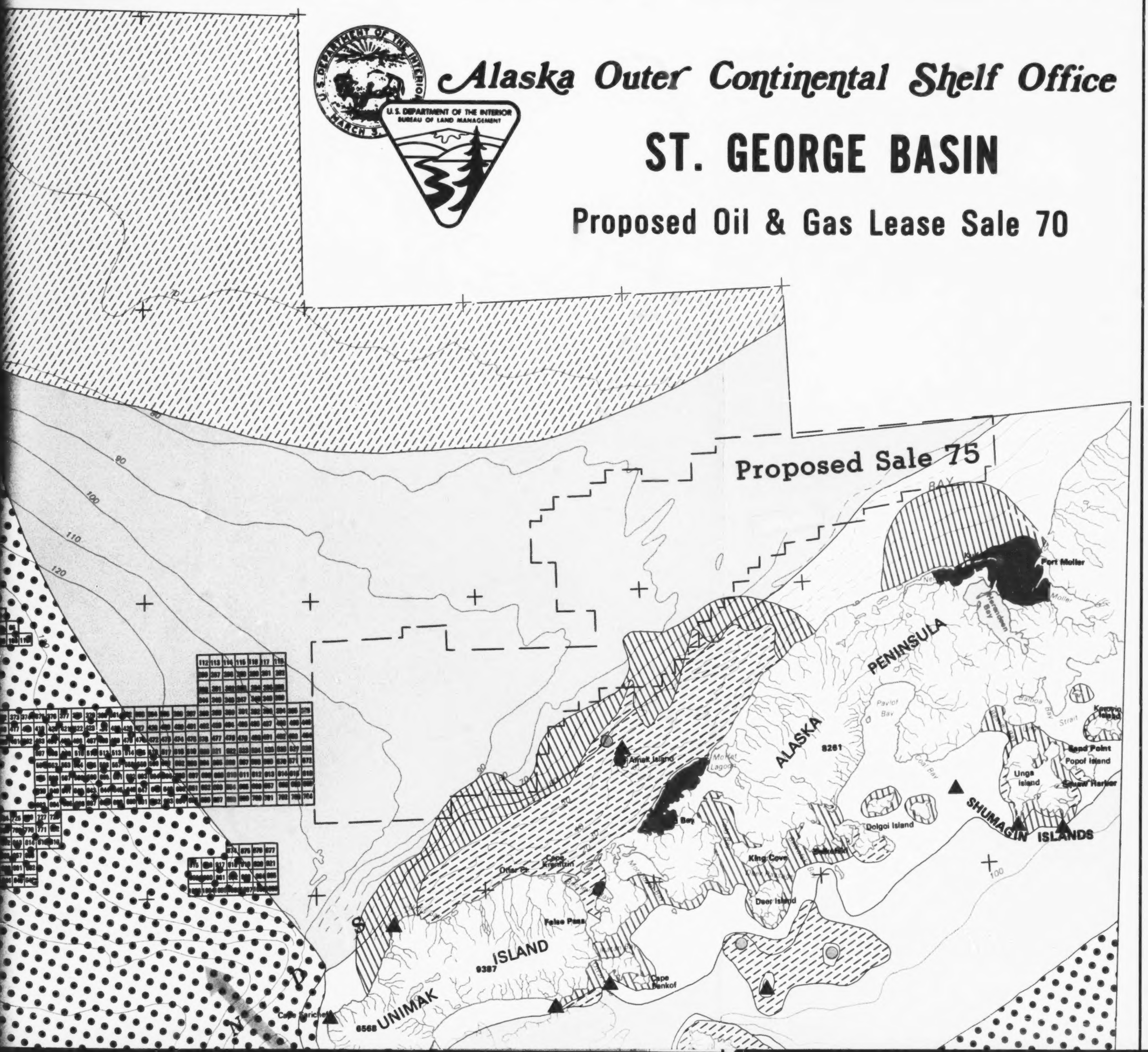
Alaska Outer Continental Shelf Office

ST. GEORGE BASIN

Proposed Oil & Gas Lease Sale 70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Sand Point
Popof Island
Unga Island
Shaw Harbor
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Dolgoi Island
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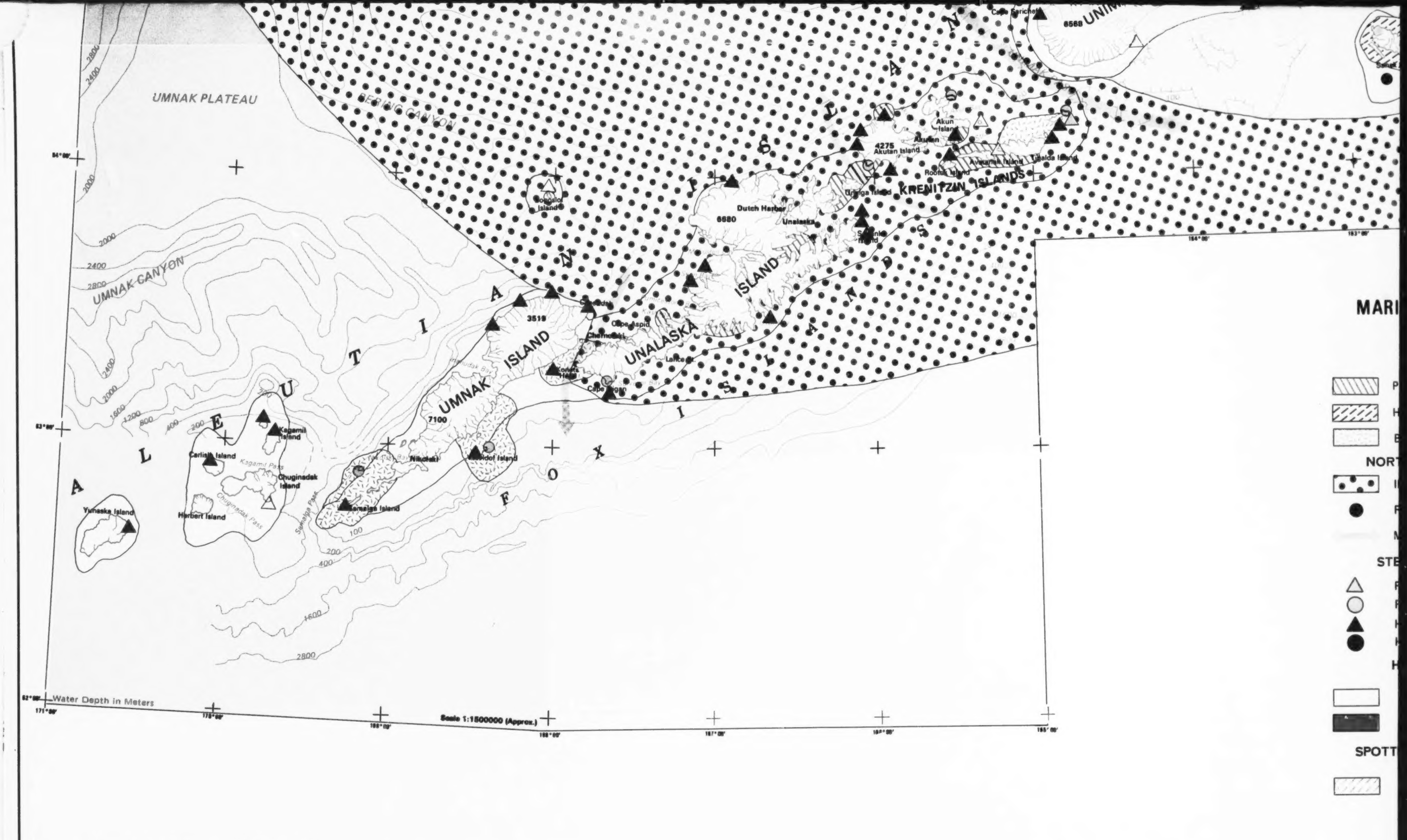
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FOX ISLANDS
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Dutch Harbor
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Avatanak Island
Rootok Island
Tigalda Island
Sedanka Island
Cape Sarichef
Cape Aspid
Chernofski
Konets Head
Cape Kigan
Nikolski
Bogoslof Island
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SOURCE: Braham, H.W., R.D. Everitt, and D.J. Rugh. 1980
Everitt, R.D. and H.W. Braham. 1979.
Frost, K. 1981.
Haley, D., ed. 1978.
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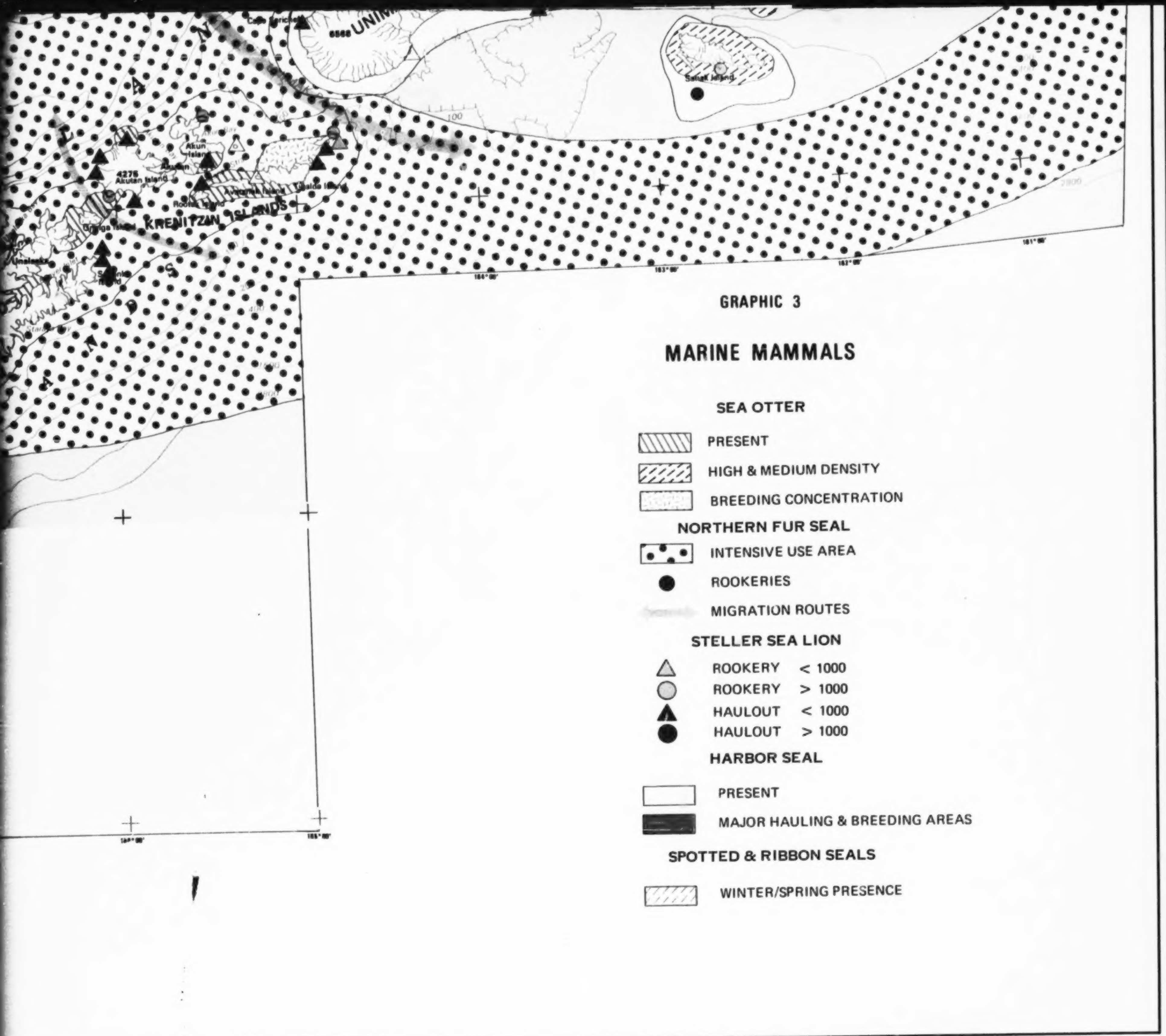
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▨ PRESENT
▨ HIGH & MEDIUM DENSITY
▨ BREEDING CONCENTRATION
NORTHERN FUR SEAL
⁘ INTENSIVE USE AREA
● ROOKERIES
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STELLER SEA LION
△ ROOKERY < 1000
○ ROOKERY > 1000
▲ HAULOUT < 1000
● HAULOUT > 1000
HARBOR SEAL
☐ PRESENT
■ MAJOR HAULING & BREEDING AREAS
SPOTTED & RIBBON SEALS
▨ WINTER/SPRING PRESENCE

GRAPHIC 3

MARINE MAMMALS

Table III.B.3.-1

Steller Sea Lion Rookeries in the Eastern Aleutian Islands, Southwestern Alaska Peninsula and Pribilof Islands with Population Estimates for June

Location	Population Estimate
Umnak Island	
Adugak Island	1800
Ogchul Island	1100
Bogoslof Island	2800
Unalaska Island	
Cape Izigan	1100
Akutan Island	
Cape Morgan	3200
Ugamak Island	4300
Round Island	270
Akun Island	1000
Tigalda Island	220
Tanginak Island	300
Amak Island	
Sea Lion Rock	2000
Sandman Reefs	
Clubbing Rocks	2700
Pinnacle Rock	3700
Sanak Island	1300
Pribilof Islands	
St. George (Dalnoi Point)	2500
Walrus Island	5000

Sources: Population estimates adapted from Alaska Department of Fish and Game (1973), Braham et al. (1977), Calkins and Pitcher (1977, 1979), Braham et al. (1980), and McAlister (1981).

In early May mature males begin arriving at the rookeries and establish territories preceding the arrival of pregnant females (Calkins and Pitcher, 1979). Of the arriving females usually all over 5 years old are pregnant (Calkins and Pitcher, 1977). Females can become sexually mature at 3 years of age (Calkins and Pitcher, 1977). Males have been little studied but apparently can become sexually mature at 4 or 5 years having returned to the rookeries when 3 years old to occupy "bachelor" haulouts. Most animals 1 to 2 years old of both sexes do not return to the rookeries.

Pupping begins in mid-May, lasting until early to mid-July. Females first leave the young to feed at sea about 5 to 12 days after giving birth. Alternating periods on land and at sea average less than 24 hours for the first 6 or 7 weeks (Sandegren, 1970). Nursing is protracted in sea lions, typically lasting from 8 to 11 months; and females often are observed nursing both a pup and a yearling. Pups enter the water on their own when about two weeks old.

Females mate on the rookery 1 to 2 weeks after giving birth, elsewhere if not parturient (Braham et al., 1977). Territorial behavior of males declines in early July and by mid-July most breeding activity has ceased. The molting period lasts from the end of breeding until October.

Sea lions usually forage in water less than 91 meters (300 ft) deep and within 24 kilometers (15 mi) of shore; however, they have been observed as far as 85 nautical miles offshore (Kenyon and Rice, 1961). In the Gulf of Alaska, 97.6 percent of Steller sea lion diet was fish, with cephalopods (Octopus) and decapod crustaceans composing 2.1 and 0.6 percent respectively (Calkins and Pitcher, 1977). A great variety of fish species were taken, including pollock, capelin, and Pacific cod. Pollock was the most important item, comprising 84.3 percent of total prey identified. In Unimak Pass, capelin was found to be the dominant prey item by Fiscus and Baines (1966).

Harbor Seal: Harbor seals are common residents of coastal areas (Graphic 3) throughout the eastern Aleutian Islands, Alaska Peninsula and Bristol Bay (Everitt and Braham, 1979, 1980), and to a lesser extent in the Pribilof Islands (Braham and Dahlheim, 1981). They are found as far south as Baja California and north into the Kuskokwim Bay (Johann, 1977). Their total population in the southeastern Bering Sea is conservatively estimated to be 30 to 35,000 (Everitt and Braham, 1980). About 20 percent of these inhabit the eastern Aleutians; most of the remaining 80 percent occupy a few major hauling areas along the north side of the Alaska Peninsula (Braham et al., 1977). Approximately 1,500 harbor seals inhabit the Pribilof Islands (Braham and Dahlheim, 1981). Three major haulout-breeding areas occur in the area considered here (Graphic 3): Port Moller (about 6,100 individuals), Izembek Lagoon (1,150) and the Isanotski Islands in Bechevin Bay (400). Estimates for the numerous lesser haulout areas are given in Everitt and Braham (1979). At 16 such areas in the eastern Aleutians, concentrations of 100 to 500 individuals have been observed at various times of year.

Movements of harbor seals are poorly understood; they appear primarily to be a sedentary species with strong fidelity to traditional haulout sites. In heavy ice years, when the bays freeze over and shorefast ice is extensive, seals are prevented from hauling out in the usual winter areas. Apparently some individuals disperse to the pack ice in winter, especially when it extends further into the southern Bering Sea in severe winters (Braham et al., 1977).

Harbor seals prefer gently sloping or tidally exposed habitats such as sandy beaches or offshore rocks and sand or gravel bars on which to haul out and give birth. Although primarily a coastal inhabitant, they have been observed up to 100 kilometers (62 mi) offshore (Fiscus et al., 1976) as well as upstream in coastal rivers (Newby, 1978). Typically they are found where water depths are less than 55 meters (180 ft) (McAlister, 1981).

Although no data are available for the Bering Sea, pupping is reported from mid-May to late June on Tugidak Island southwest of Kodiak Island (Pitcher and Calkins, 1977). Pitcher and Calkins (1979) determined that Gulf of Alaska females become sexually mature at 3 to 7 years, males from 5 to 7 years. Pregnancy rates range from 17 percent in 4 year old females to 100 percent in those 8 years old. Pups are able to enter the water soon after birth and weaning occurs 3 to 5 weeks later (Bishop, 1967; Johnson, 1977). Mating occurs from late June to late July within 2 weeks after females have ceased nursing their pups (Pitcher and Calkins, 1977, 1979).

Physical condition, as indicated by blubber thickness, is highest from November to mid-May; seals are thinner during summer months. This is probably associated with energetic demands of lactation, breeding and molting (Pitcher and Calkins, 1979). Lowest levels occur during the peak molting period, mid-July to mid-September.

Harbor seals are opportunistic feeders and thus their diet varies according to season and location. In the Gulf of Alaska, Pitcher and Calkins (1979) found that fish comprised 73.8 percent, cephalopods 22.2 percent, and decapod crustaceans 4.1 percent of the occurrences of prey items. The three most frequently taken species were walleye pollock (*Theragra chalcogramma*), octopus, and capelin (*Mallotus villosus*).

Spotted Seal: This seal is distinguished from the harbor seal by its seasonal dependence on sea ice for breeding, pupping and molting whereas harbor seals breed and molt on land. Since spotted seals are associated with southern portions of the ice front, the 24 to 129 kilometer (15-80 mi) wide area between fringe and heavy pack ice (Burns et al., 1980), they are found in the proposed sale area primarily in winter and spring (January through April; Frost, 1981). Their abundance varies with the extent, physical characteristics, and timing of formation or disintegration of sea ice. Greatest concentrations occur from southern Bristol Bay to the southcentral Bering Sea east of the Pribilof Islands (McAlister, 1981; Frost, 1981). Most individuals occur singly or as scattered pairs. Pairing takes place in March, prior to the birth of pups on drifting sea ice from late March through April. Pairs remain together until early May by which time pups are weaned, having nursed for 3 to 4 weeks, and adults have mated. Molting occurs from mid-March through June (Burns and Harlo, 1977). During May and June, when the disintegrating ice front has retreated from the proposed sale area, adults and pups are concentrated on seasonal ice remnants, while subadults move to coastal areas (McAlister, 1981).

From 200,000 to 250,000 spotted seals are estimated to inhabit the entire Bering Sea (Lowry and Frost, in press). An estimated 150,000 of these reside in the eastern Bering Sea during winter. Peak densities are found in the front zone from January through April. Only about 10 percent of this number stay there in summer (Fay, 1974).

Recently weaned pups feed on amphipods, shrimp and sand lance (Lowry et al., 1979). Adults utilize a variety of schooling and bottom fish including walleye pollock, herring, smelt, eulachon, saffron cod, arctic cod, greenling, and flatfishes, as well as octopus and shrimp. The abundance of spotted seals at the ice front in late winter probably is associated with prey abundance just north of the shelfbreak (Bruce and Hahn, 1977).

Ribbon Seal: Although also inhabiting the southern fringe of pack ice (Graphic 3) ribbon seals are distributed further west than spotted seals; from just east of the Pribilof Islands to the western Bering Sea (McAlister, 1981). Like the spotted seal, they have only a seasonal ice association, occupying the ice front in late winter and spring, abandoning it apparently for a pelagic existence in the Bering Sea in summer and fall (Burns, 1970). Summer distribution characteristics are unknown. They rarely are found in nearshore environments and are not known to haul out on land (Fay, 1974). Estimates of the Bering Sea population range from 60,000 to 114,000 (Braham et al., 1976; Burns, 1978; Brooks, 1979).

Ribbon seals rely extensively on the ice at the front for resting, breeding, pupping, nursing, and molting. Pupping occurs on the ice from late March to mid-April. Nursing lasts about four weeks. Breeding occurs from late April to mid-May as the sea ice begins to disintegrate and the southern edge moves northward.

While they are associated with sea ice, ribbon seals feed on shrimps, amphipods, mysids, crabs, cephalopods and various fishes (Frost and Lowry, 1980). Lowry et al., (1979) found that seals taken southwest of St. Lawrence Island in May and June fed primarily on pollock. Ribbon seals forage in water depths of from 60 to 100 meters (197-328 ft) (Braham et al., 1977).

Sea Otter: Since protection by international treaty in 1911, sea otters have reoccupied much of their former range (California-Bering Sea-Japan) including several areas in the southeastern Bering Sea (Schneider, 1976, 1981). Significant concentrations of sea otters are found in the Samalga-southwest Umnak Island area, around Vsevidof Island, in Umnak Pass, in the Tigalda Island area and in the Unimak Island-Alaska Peninsula area (Graphic 3). Lower densities are found in the vicinity of Port Moller and Unalga and Akutan Passes. Attempts to reestablish a viable Pribilof Islands population have been unsuccessful.

Surveys made between 1957 and 1976 indicate that by 1970 sea otters had expanded their range north of Port Heiden, but severe winter conditions in 1971, 1972 and 1974, when ice advanced south to Unimak Island, resulted in the deaths of hundreds if not thousands of individuals, and forced a retreat to the south from which the population has not yet recovered.

Schneider (1976) conservatively estimated the Port Moller-Unimak Island population at 17,173 otters for an overall density of 3.9 individuals/kilometer^2, with 6.5/kilometer^2 in high density areas (Graphic 3). Pods of 100 animals are not uncommon in this area and one containing over 1,000 has been sighted near Amak Island (Schneider, 1981).

Sea otters inhabit clean coastal waters less than 90 meters (295 ft) deep; highest densities usually are found within the 40 meter (131 ft) isobath where young individuals and females with pups forage. Densities observed by Schneider (1976) averaged 3.1 otters/kilometer^2 in water 0 to 20 meters (0-66 ft) deep, 5.8/kilometer^2 in 20 to 40 meters (66-131 ft) and 0.5/kilometer^2 in 40 to 60 meters (131-197 ft) water. Deeper waters are used for foraging principally by adult males. Otters' preferred habitat includes kelp beds and offshore reefs and rock shores exposed to the open ocean (Lensink, 1962).

Otters may breed at any time of year but this activity reaches a peak in September, October, and November (Alaska Department of Fish and Game, 1973); pupping peaks from April through June. Productivity is low, with females normally producing one pup every two years from age four. Molt is prolonged over the entire year rather than seasonal as in other marine mammals.

To maintain their high metabolic rate, sea otters consume 20 to 25 percent of their weight in food each day (8-15 pounds). Food consists primarily of benthic invertebrates, such as bivalves, sea urchins, crabs and octopus. Where invertebrate populations have been depleted, they subsist on demersal fishes. Since there is no indication that sea otters can obtain pelagic food items, long migratory movements in the open ocean are precluded (Kenyon, 1969). The primary factor limiting sea otter population growth in specific locales is food availability (Schneider, 1976).

4. *Endangered Species and Non-Endangered Cetaceans*: There are at least 16 cetacean species which may occur in or near the proposed sale area. Eight of these species are considered to be endangered. Two avian endangered species may occasionally occur, seasonally or as transients, in coastal areas near the proposed sale area. As defined in the Endangered Species Act of 1973 as amended, an endangered species is any species which is in danger of extinction throughout all or a significant portion of its range, whereas a threatened species is a species which is likely to become an endangered species within the foreseeable future.

There are no animal species officially listed as "threatened" or intended for listing in the proposed sale area. Also, there are no listed endangered plants in the area or in areas immediately adjacent to it. Listed endangered species which *may occur* in the proposed sale area, as reported in the *Federal Register* (Vol. 44, No. 12), include the gray whale (*Eschrichtius robustus*), humpback whale (*Megaptera novaeangliae*), fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera borealis*) blue whale (*Balaenoptera musculus*), sperm whale (*Physeter macrocephalus*), right whale (*Balaena glacialis*), bowhead whale (*Balaena mysticetus*), the Aleutian Canada Goose (*Branta canadensis leucopareia*), and the peregrine falcon (*Falco peregrinus*). Other species listed as endangered may occur very rarely , if at all. These include the short tailed albatross (*Diomeda immutabilis*) and Eskimo curlew (*Numenius borealis*). Neither of the latter two species are known to make significant use of or have been recently reported in or near the proposed sale area. Mammalian species discussed herein are protected under the Marine Mammal Protection Act of 1972. The Aleutian Canada goose is also protected by various acts and treaties.

Cetaceans that are not endangered but which occur in or near the proposed sale area are the beluga whale (*Delphinapterus leucas*), killer whale (*Orcinus orca*), minke whale (*Balaenoptera acutorostrata*), Dall's porpoise (*Phocoenoides dalli*), and harbor porpoise (*Phocoena phocoena*). Species less well known and less frequently observed, but which may occasionally occur in or near the proposed sale area, include beaked whales, Bering Sea beaked whale (*Mesoplodon stejnegeri*), goosebeak whale (*Ziphius cavirostris*), and the giant bottlenose whale (*Berardius bairdii*).

Available information on the range and distribution of species most numerous in or near the proposed sale area is summarized below. The reader is directed to Martin (1977), Coffey (1977), Haley (1978), Slijper (1979), and Alaska OCS Technical Paper No. 5 (Cowles, 1981) for additional accounts of habitat requirements and natural history of various cetacean species.

Endangered Species:

Gray Whale: The gray whale occurs only in the north Pacific and adjacent waters of the Arctic Ocean (Rice and Wolman, 1971). Population estimates vary between researchers. Recent estimates place the eastern (California) population at about 16,500 (Reilly et al., 1980). The species is probably approaching or may have exceeded pre-exploitation levels of abundance.

The primary summer range of this species is in the Bering Sea, Chukchi Sea, and western Beaufort Sea (Rice and Wolman, 1971). The east Pacific stock of gray whales migrates in spring through the Gulf of Alaska, through Unimak Pass from April to June, nearshore around the perimeter of Bristol Bay, (Fig. III.B.4.-1) and north to Nunivak Island (Braham et al., 1977). Recently, peak occurrence in spring at Unimak Pass was in late April and early May. Available data indicate that from Nunivak Island, most swim directly to the vicinity of St. Lawrence Island and the northern Bering Sea, leaving the nearshore habitats such as utilized to the south.

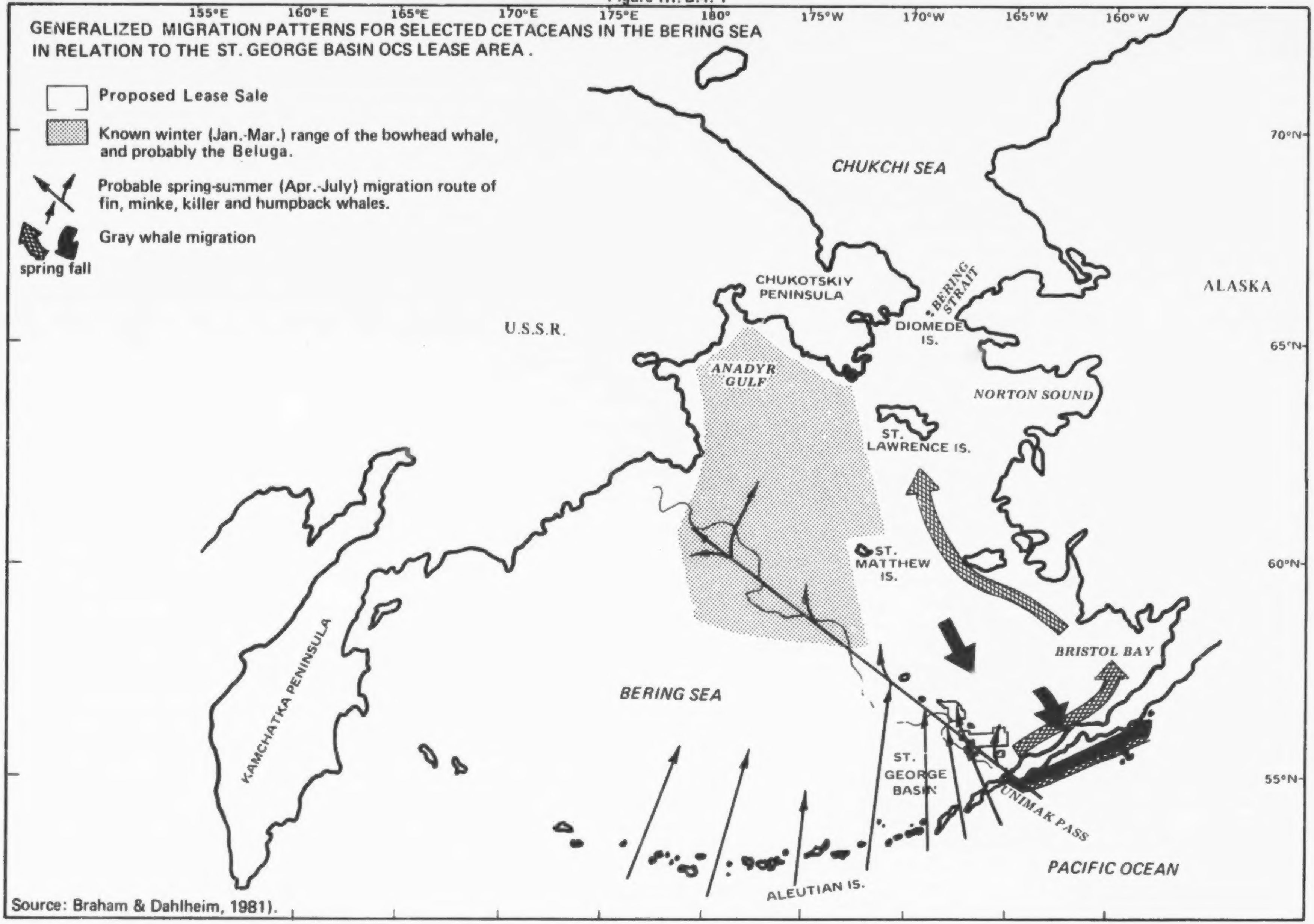
According to Braham and Dahlheim (1981), some migrate directly to the Pribilof Islands vicinity. Several dozen are seen there annually. During the southbound migration (mid-October to late December), it is suspected that a large segment of the population migrates directly through the northeastern portion of the St. George Basin (Fig. III.B.4.-1). Gray whales are benthic feeders, which, like most other baleen whales, probably acquire the bulk of their nutritional needs during the summer feeding period. The northern Bering Sea, north of St. Lawrence Island, is probably the most important feeding habitat of this population.

Humpback Whale: Next to the right whale, this species is probably the rarest of the cosmopolitan baleen whales (Wolman, 1978), possibly numbering around 850 to 1400 in the entire north Pacific (Fiscus et al., 1976; Braham, 1980, personal communication). The species ranges from the equator to the southern Chukchi Sea. Centers of abundance of the species in the north Pacific historically have been in the Gulf of Alaska and southestern Bering Sea (Berzin and Rovnin, 1966).

According to Berzin and Rovnin (1966), the largest number of humpback whales seen in Alaskan waters "was encountered from the region to the south of the eastern Aleutian Islands (Fox Island) to the western part of the Gulf of Alaska into the north of Unimak Strait, i.e., approximately 170° W. longitude to 145° W. longitude." The species is known to winter on the Asiatic coast, near the Hawaiian Islands, and along the west coast of Baja, California. Mating and calving occur during the winter period. Humpback whales from

Figure III. B.4.-1

GENERALIZED MIGRATION PATTERNS FOR SELECTED CETACEANS IN THE BERING SEA IN RELATION TO THE ST. GEORGE BASIN OCS LEASE AREA.



Proposed Lease Sale
Known winter (Jan.-Mar.) range of the bowhead whale, and probably the Beluga.
Probable spring-summer (Apr.-July) migration route of fin, minke, killer and humpback whales.
Gray whale migration
spring fall
155°E
160°E
165°E
170°E
175°E
180°
175°W
170°W
165°W
160°W
70°N
65°N
60°N
55°N
CHUKCHI SEA
CHUKOTSKIY PENINSULA
BERING STRAIT
DIOMEDE IS.
ALASKA
U.S.S.R.
ANADYR GULF
NORTON SOUND
ST. LAWRENCE IS.
ST. MATTHEW IS.
KAMCHATKA PENINSULA
BERING SEA
BRISTOL BAY
ST. GEORGE BASIN
UNIMAK PASS
PACIFIC OCEAN
ALEUTIAN IS.

Source: Braham & Dahlheim, 1981).

BEST DOCUMENT AVAILABLE

Mexican waters begin their northward migration in March and April, moving along the North American coast and probably entering the Bering Sea via Unimak or other Aleutian passes. Some reach the Bering Strait and Chukchi Sea in July and August. The northward route of humpback whales wintering in Hawaii is unknown. Their summering areas are possibly near the Aleutian Islands west of Kodiak Island (Wolman, 1978). Humpbacks occur from May to November in the St. George Basin area. Prior to 1966, the southern area of the basin was utilized by large numbers of humpbacks. They were exploited heavily by whalers based at Akutan in the early 1900's although sightings still occur in the area relatively frequently (Braham and Dahlheim, 1981). The numbers that presently utilize the St. George Basin are unknown.

Fin Whale: As many as 17,000 fin whales may occur in the entire North Pacific (Fiscus et al., 1976; Mitchell, 1978). A considerably smaller number of them occur in the Bering Sea; however, the population level is best considered "unknown" in the Bering Sea (Braham and Dahlheim, 1981). Like other baleen whales, they are a migratory species, found in the Bering Sea primarily during the summer months. Regular concentrations occur in the Gulf of Alaska along the Aleutian Chain. Previously, they were encountered frequently and in relatively greater numbers south of the Pribilof Islands and at about 61° N. latitude between Nunivak and St. Matthew Islands (Berzin and Rovnin, 1966). West of the Pribilof Islands, they have been observed along the shelf break. According to Berzin and Rovnin (1966) relatively low abundance occurs in summer in the western Bering Sea from Cape Navarin to Karagin Island. During spring migration, fin whales first occur in southeastern Alaskan waters in March and peak there in April. Peak occurrences in the Kodiak Island-northern Gulf of Alaska begin in May (Fiscus et al., 1976). Not all fin whales found near the proposed sale area pass through Unimak Pass, some move along the eastern Aleutians toward the Commander Islands (Berzin and Rovnin, 1966), and probably through other Aleutian Island passes. Although fall migration of fin whales begins in September in the Bering Sea, this species remains in the Aleutian Island vicinity and the Gulf of Alaska until November, with some fin whales possibly wintering in the southeastern Aleutian and Gulf of Alaska area (Berzin and Rovnin, 1966). According to Braham and Dahlheim (1981), fin whales can occur for six to eight months in the St. George Basin, and appear to differentially concentrate over the continental slope and shelf in response to food resources. Additional information on food habits, reproduction, and Bering Sea distribution is available in Alaska OCS Technical Paper No. 5 (Cowles, 1981), Haley (1978), and other sources.

Sei Whale: The sei whale population in the entire north Pacific is perhaps as much as 8,600 to 9,000 animals (Fiscus et al., 1976). However, at present accurate estimates are unavailable and the species population status in the North Pacific and/or Bering Sea is best considered "unknown" (Braham and Dahlheim, 1981). The latter authors did not discuss utilization of the Bering Sea by this species "for lack of data." Tomilin (1957) reported greatest abundance of the species was in waters near Japan. This is also indicated by catch statistics portrayed by Masaki (1977, Fig. 3). Although their occurrence has been reported as extending as far north as the Bering Strait in North American coastal waters, greatest harvest during the whaling years was near British Columbia (Tomilin, 1957). Masaki (1977) reported sightings in the Bering Sea from 1965 to 1972 occurred as far north as St. Lawerence Island in August; however, greatest numbers of sightings reported by Masaki in May and June occured south of the Aleutian Islands, and, in July and August, in the western Bering Sea. In the St. George Basin the species is sighted rarely and its "peak" occurrence is probably from June to August. Based on Masaki's data, most probable occurrence in the region is immediately south of the Aleutian Chain. Braham et al. (1977) showed one sighting in the Platform of Opportunity data base covering 1952 to 1976 in the southeastern Bering Sea, and none for the period 1958 to 1978 (Braham and Dahlheim, 1981).

The sei whale migration is frequently characterized as similiar to those of fin whales, although they are thought to prefer warmer waters than other rorquals (Tomilin, 1957). Fiscus et al. (1976) decribed the species as an offshore, continental shelf inhabitant.

Bowhead Whale: Bowhead whales probably number close to 2,200 animals in the Bering Sea stock. They occupy habitats of the Bering Sea in winter, primarily from January to March. Their range during this period is the west-central Bering Sea. During average ice years they spend the winter in the pack ice from St. Lawrence Island south to St. Matthew Island, in heavy ice years as far south as the Pribilofs (Braham et al., 1980). They rarely are found south or east of the Pribilof Islands. Only three sightings have been made since 1976 in the St. George Basin area, and one was probably a duplicate (Braham et al., 1979). According to Braham et al. (1979) "given our present state of knowledge, the outer Bristol Bay-St. George Basin OCS area east of 170° W. longitude and south of 59° N. latitude does not include important or traditional habitat for the bowhead whale. If during those years when ice extends to its maximum southern limit (similar to 1976) and if unusual ice or storm conditions force whales to move further southeast than normal, then some whales are likely to occur here."

Blue Whale: Perhaps as many as 1,600 to 1,700 blue whales still may be found in the North Pacific (Fiscus et al., 1976), although other estimates have placed their abundance at about 1,500. In the north Pacific, the blue whale is distributed on the west from Baja California north to the Bering Sea (Berzin and Rovnin, 1966; Nishiwaki, 1966). In its summer range, this species occurs in relative abundance in an area just south of the Aleutian Islands from 160° W. longitude to 175° W. longitude (Rice, 1974; Berzin and Rovnin, 1966). It is also distributed from an area north of 50° N. latitude extending southeast of Kodiak Island across the Gulf of Alaska and southeastern Alaska Vancouver Island (Berzin and Rovnin, 1966).

According to Berzin and Rovnin (1966), The spring migration of blue whale begins in April to May as whales travel north along the American shore of the Pacific. Whaling records indicate a peak occurrence of blue whales near the Aleutian Islands in June and July (Rice, 1974). Berzin and Rovnin (1966) stated that, in the Bering Sea, blue whales have only been observed to the south of the Pribilof Islands and possibly enter the Bering Sea rarely. There have been no recent sightings in the Bering Sea (Braham, H. W., 1981, personal communication). Fall migration of the blue whale begins in September; the animals move south (Berzin and Rovnin, 1966) to wintering areas off Baja California and near the equator (Fiscus et al., 1976).

Sperm Whale: The sperm whale is the only toothed whale that is listed as endangered. The north Pacific population of male sperm whales has been estimated at about 90,000 animals (Fiscus et al., 1976). Although the total population of both sexes combined is believed to be about 200,000 animals, an estimate for the Bering Sea is not available. The species is distributed in the Pacific from the equator north to the Cape Navarin region in the Bering Sea (Berzin and Rovnin, 1966). Relatively large numbers of sperm whales regularly occur off Kodiak Island to the west along the Aleutian Chain as far as the Commander Islands (Berzin and Rovnin, 1966). Those sperm whales that do enter the Bering Sea (primarily males), migrate along the shelf break, south of the Pribilof Islands and west to the vicinity of Cape Navarin. Although the northern most part of their range is near Cape Navarin, the northern boundary of their range appears to run from Cape Navarin to the Pribilofs, along the continental shelf (Berzin, 1971).

The regions of highest concentration of sperm whales are generally associated with a sharp increase in water depth such as the underwater slopes off the Aleutian Islands (Berzin and Rovnin, 1966). As for the blue whale, Fiscus et al. (1976) described the sperm whale as primarily an oceanic (shelf slope and off the continental shelf) inhabitant. Migration of sperm whales north to Alaskan waters begins in March and continues through May along several migration routes (Berzin and Rovnin, 1966). According to Berzin (1971), migration routes in the Aleutian Island vicinity follow the Aleutian Chain westward and through the various passes into the Bering Sea. Unimak Pass is probably utilized, as well as other straits. Mature males migrate to more northern latitudes, but females and young males seldom migrate above latitude 50° N. (Berzin and Rovnin, 1966). Other workers (e.g., Nishiwaki, 1967) consider the 10 degrees C isotherm a boundary designating the northern extension of habitat of female and young sperm whales. Berzin and Rovnin (1966) noted concentrations in the Bering Sea occurred south of the Pribilof Islands and north of Atka Island. Occasionally males are observed feeding in deeper waters off the continental shelf north of the Aleutian Islands (Braham and Dahlheim, 1981). Berzin (1971) concluded that the bulk of the males occur from Kodiak Island west along the Aleutian arc to the Commander Islands, with large accumulations occuring south of Unimak Pass. Fall migration begins in September with most whales leaving the Gulf of Alaska by the end of November (Berzin and Rovnin, 1966; Fiscus et al., 1976). The breeding season and location of breeding and calving are unknown.

Right Whale: This species is the most rare of the endangered whales. Perhaps 150 to 200 survive in the North Pacific. The north Pacific population was distributed on the western side of the Pacific from California north as far as the Bering Strait. The northern extent of their present range is considered to be the southeastern Bering Sea (Berzin and Rovnin, 1966; Rice, 1974). Berzin and Rovnin (1966) concluded that the right whale once occurred seasonally in the southeastern Bering Sea in a region delimited by a line connecting Atka, St. Matthew, and Nunivak Islands. Also their range was described as extending along the southern side of the Aleutian Chain westward as far as the Commander Islands. Recently (1980), sightings of this species near Yakutat were reported; no other sightings in the eastern North Pacific have been reported in recent years. Right whales are so uncommon that they may be "biologically extinct" (Braham and Dahlheim, 1981). The entire Gulf of Alaska from Vancouver Island-Alexander Archipelago to the eastern Aleutian Islands is within the right whales's summer range and encompassed the "best" whaling grounds for this species (Rice, 1974; Fiscus et al., 1976). In the north Pacific, the area of greatest seasonal utilization by right whales is probably the northern Gulf of Alaska between longitudes 145° W. to 151° W. south to about latitude 50° N. (Berzin and Rovnin, 1966).

Endangered Whale Summary: Of the endangered cetacean species, gray, fin, sperm, and humpback whales are those most likely to occur in or near the proposed sale area, primarily during summer months. Greatest concentrations of these species occur locally near the Pribilof Islands, along the continental shelf break, and in the vicinity of certain Aleutian Islands and passes. Unimak Pass is probably an important (but not the sole) migration corridor into the Bering Sea for population segments of fin, humpback, and sperm whales. The latter species could be expected to be moving through the passes throughout the warmer months; the bulk of the gray whale population utilizes Unimak Pass during the spring and fall months only. Nearshore areas in the vicinity of the Aleutian Islands, especially the Fox Islands, are locations of relatively frequent sightings of these species, especially humpbacks (Braham and Dahlheim, 1981). Overall, peak sightings of the various species in the St. George proposed sale area tends to occur in June (Braham and Dahlheim, 1981).

Aleutian Canada Goose: Aleutian Canada geese once bred from the eastern Aleutian Islands to the Kuril Islands. Today, the only known breeding population of the species utilizes Buldir Island (about 700 miles from the proposed sale area) and appears to winter in California. Reintroductions of the birds have occurred and are planned for various locations in the Aleutian Islands (Springer et al., 1977). Estimates of abundance in 1975 placed the population of this species at about 800 birds. Springer et al. (1977) estimated the spring population at about 1,150 birds. The fall population in 1977 was estimated to be 1,600 geese. During the fall (as early as August) the geese leave Buldir Island and migrate eastward along the Aleutian Islands to possible staging areas on the north coast of Unimak Island (USDI, 1980). From there they probably migrate directly over the North Pacific to wintering areas in California.

Peregrine Falcon: The two subspecies of peregrine falcon which are listed as endangered are the arctic peregrine (*F. p. tundrius*) and the American peregrine (*F. p. anatum*). Birds observed frequenting Aleutian Island habitats are typically the non-endangered Peale's peregrine falcon (*F. p. pealei*), a subspecies noted for its preference for marine coastal habitats. There have been few, if any, confirmed sightings of the arctic peregrine or the American peregrine along the Aleutian Chain or western Alaska Peninsula. The U.S. Fish and Wildlife Service biologists in the Aleutian Islands (west of Unimak Pass) talleyed 16 peregrines during recent incidental observations(J. Trapp, U.S. Fish and Wildlife Service, 1980 personal communication). Fyfe et al. (1975) estimated that as many as 375 to 580 breeding pairs of peregrine falcons occur in the entire Aleutian Islands region. Peale's peregrines have also been reported (in 1914) to occur in the Pribilof Islands (Fyfe et al., 1976), but, apparently, no peregrines have been reported there since then (Roseaneu, D., LGL Research Associates; personal communication, 1980). Thus it can be concluded that certain locations, especially cliff habitats near seabird colonies in the eastern Aleutian and western Alaska Peninsula coastal areas can be considered likely peregrine habitat, but not for the endangered subspecies.

Non-Endangered Cetaceans:

Beluga Whale: A toothed whale, belugas in Alaska consist of the Cook Inlet-Gulf of Alaska, and Bristol Bay-northern Bering Sea populations. There are probably about 1,000 to 1,500 in Bristol Bay, and several thousand further north. Those of the Bering Sea are largely migratory, however, the relationship of the Bristol Bay group to those of the rest of the Bering Sea is not known. Belugas occur in Bristol Bay year round, especially in summer. Sergeant and Brodie (1975) estimated that 5,000 belugas occupied the McKenzie River Delta in July 1974. Since most belugas found there are migrants from the Bering Sea (Fraker, 1979), the total number of belugas seasonally in the northern Bering Sea is in excess of that figure. An ice associated species, it is likely that belugas occupy Bering Sea open pack ice and the ice front zone during the winter period. They can occur in the St. George Basin area in winter, and in spring, in association with seasonal pack ice (Braham and Dahlheim, 1981); they are probably absent in ice-free years or seasons.

Minke Whales: One of the smaller (about 30 feet at maturity) baleen whales, the minke inhabits all oceans of the world except equatorial regions. The species occurs broadly over the north Pacific and into the southeastern Chukchi Sea during the summer months and migrates to southern latitudes (below lat. 25° N.) during winter. They are considered to be of low abundance (Mitchell, 1978), but they are not considered to be endangered. No population estimate is available (Brooks, 1979) either for the north Pacific or northern Bering Sea. Sightings of this species have occurred in pack ice in April. They occupy the St. George Basin-Bering Sea area, apparently on a year round basis, with concentrations occurring during summer months near the Aleutian Islands (Braham and Dahlheim, 1981).

Killer Whale: Migration of the killer whale is not well understood; they probably undergo a migration correlated to their prey, especially fishes. The killer whale ranges throughout the St. George Basin at all seasons but appears more abundant during summer months. They are especially common just south of the Pribilof Islands on the continental shelf and slope (Braham and Dahlheim, 1981).

Dall's Porpoise: This species ranges from Baja California along the west coast of North America, across the North Pacific Ocean, to the coastal waters of Japan. They occur in St. George Basin during the entire year, however, they are most abundant near the continental slope in summer. Migratory movements are not well understood, available information suggest local migrations along the coast and seasonal onshore-offshore movements through the proposed sale area. Calving, as well as feeding, is believed to occur in and or near the proposed lease sale area (Braham and Dahlheim, 1981).

Harbor Porpoise: The harbor porpoise is a boreal-temperate zone species found along much of the North Pacific coast between Point Barrow, Alaska and central California. They inhabit the proposed sale area although they may be relatively scarce; very few sightings have been made. Their occurrence appears to increase south and east of the basin in coastal waters (Braham and Dahlheim, 1981).

Other Toothed Whales: The goosebeak whale is believed to occur over deeper, pelagic waters although they have been reported in coastal waters west of the proposed sale area. The giant bottlenose whale ranges from St. Matthew Island southward through the Bering Sea and is likely to be found in the proposed sale area. The Bering Sea beaked whale is also considered an inhabitant of offshore, deeper waters. Little is known about the seasonal movements or density of these species since they are rarely observed.

C. Social Systems

1. Population and Settlement Patterns: The Aleutian, Pribilof, and Shumagin Islands and the lower Alaska Peninsula are the traditional homeland of the Aleut people. Estimates of the precontact Aleut population range from 15,000 to 30,000 people (Don Bantz and Associates, 1977). This population was distributed in shoreline villages throughout the area and has been estimated to comprise 169 settlements in 1740 (Coppock, 1969). Occupation of the Aleutian area by the Russians in 1741 triggered a rapid population decline among the Aleut people, forcibly appropriated from traditional lifeways to serve the needs of Siberian fur hunters. Consolidation of villages and the relocation of Aleuts was commonplace to capitalize on the superior skill of Aleut maritime hunters, to the extent that only 39 villages were in existence after a century of Russian occupation (Jones, 1973). The previously uninhabited Pribilof Islands were settled through relocation after discovery by the Russians in 1786 (Aleut maritime hunters may have known of the islands prior to this date). Atrocities, deprivation, and disease characterized the period of Russian presence, resulting in the Aleut population being reduced to an estimated 2,000 at the time of Alaska's purchase by the United States in 1867 (Don Bantz and Associates, 1977). The effects of Russian-forced cultural change, characterized by low birth rates, high mortality rates, and extensive disease (through lack of natural immunity) continued through the early territorial period. By 1930, the Aleut population was estimated to number around 1,000 (ibid.).

The historic patterning of village growth and decline through intervillage migration in the Aleutians area, exclusive of the Pribilof Islands, is documented by Jones (1973) from 1890 to 1970. According to this research, substantial intervillage migration has occurred since 1890. This reflects a dominant but not exclusive pattern characterized by the economic competitive advantage of villages to provide job opportunities, people seeking a better and more stable life centered on the wage economy, and the proximity of advantaged villages to those undergoing depopulation. One exception to the dominant theme is found in cases where economically advantaged villages are considered unattractive, and options other than permanent relocation are used to maintain a different mode of living over time. The other key exception resulted from the government discouraging Aleuts from returning to small depopulating villages (primarily Chernofski, Makushin, Biorka and Kashega in the Umnak-Krenitzin Islands group) after being relocated back to the Aleutians following internment in southeast Alaska during World War II. In 1890, the U.S. Census recorded 22 places of habitation in the Aleutian area; by 1970 the number had been reduced to 13, and by 1980 to 12.

a. Population Trends: In 1980, the Aleutian Islands census area had a population of 7,689, which comprised about 2 percent of Alaska's total population preliminary count of 400,331. This 1980 population count represents an approximate 2 percent decline in population from the 1970 count of 7,879, the net effect of a 1,514 decline in military population, and a 1,324 increase in civilian resident population. The civilian population increase is attributed to a natural increase of the resident population of 1,101 and the implied net effect of migration by adding 223 to the resident population (Alaska Department of Labor, 1981).

The distribution of population among towns, villages, and military installations existing in the Aleutian Islands census area in 1980, and the historic trends in population growth or decline in these communities are shown in Table III.C.1.a.-1. Some 51 percent of the total population in 1980 was attributed to military and Coast Guard installations located on the westernmost islands of the Aleutian chain at Attu (Coast Guard), Shemya (Air Force), and Adak (Navy). Other government personnel were stationed at smaller installations within the census area in numbers not as readily separated from the resident population. The major civilian population centers in 1980 occurred at St. Paul in the Pribilof Islands, the Unalaska/Dutch Harbor complex (officially the City of Unalaska) on Unalaska Island, King Cove and Cold Bay on the southern Alaska Peninsula, and Sand Point in the Shumagin Islands. Except for the Pribilof Islands, Unimak Pass is used as the geographic demarcation for the following discussion of community-level trends and composition of the population.

Pribilof Islands: The past rates of growth for St. Paul primarily have been defined by rates of natural increase and out-migration. Between 1960 and 1970, it is probable that continued out-migration of young people from the island took place. Much of the growth has been attributed to the migration of St. George residents who were actively encouraged by the Bureau of Commercial Fisheries (now the National Marine Fisheries Service) to move permanently to St. Paul (Alaska Consultants, 1981). St. Paul experienced modest population gains between 1970 and 1980. Excluding the 22 individuals living in group quarters at the Coast Guard LORAN station, St. Paul had an average growth rate of 1.6 percent between 1970 and 1980 (ibid.).

West of Unimak Pass: The communities in this area located west of Unimak Pass are Atka, Nikolski, Unalaska, and Akutan. Among population centers in the region, Unalaska experienced significant growth during the decade of the 1960's with the establishment of a major shellfish processing industry, and exploded with an almost fourfold increase in population in the next decade from 342 in 1970 to 1,301 in 1980. Additional seasonal migrants are estimated to range from 700 to 3,000 individuals. Akutan, the other center of shellfish processing, unlike Unalaska, has maintained a village scale of population of around 80 to 100. Akutan increased in population by 25 percent in the decade of the 1970's to 126 persons in 1980. The floating seafood processors in Akutan Bay are estimated to contribute an additional 200 to 800 individuals to its population during fishing season.

The villages of Atka and Nikolski are much more isolated from the direct population affects of the seafood processing industry. Atka has maintained a population in the vicinity of 100, whereas the population of Nikolski appears to be declining. Nikolski's population was recorded at 50 persons in 1980 in comparison with the post-war high population of 92 established in 1960. As opposed to the population effects of seasonal in-migrants experienced elsewhere, seasonal or long-term out-migration for employment has been the mode for maintaining residence in Atka and Nikolski.

East of Unimak Pass: The villages and towns located east of Unimak Pass are Nelson Lagoon, False Pass, Cold Bay, King Cove, Belkofski, Sand Point, and Squaw Harbor. Among these, Sand Point and King Cove have evolved into important fishing, processing, and service centers since World War II, demonstrating the function of competitive economic advantages and illustrating a contin-

Table III.C.1.a.-1
Population Trends, Aleutian-Pribilof Islands Area (Aleutian Islands Census Area)

	1890	1900	1910	1920	1930	1940	1950	1960	1970(1)	1980(1)	Percent of Change 1970-1980	Transient(5)
Westward Aleutians												
Attu	101	98			29	44				29		
Shemya Station								124(2)	1,131	600	- 47	
Adak Station									4,022	3,313	- 18	
Pribilof Islands												
St. Paul(4)	203			188	222	273	359(3)	378(3)	450	551	+ 22	
St George(4)	88			122	142	185	187(2)	264(2)	163	158	- 3	
West of Unimak Pass												
Atka	132	128		56	103	89	85	119	88	93	+ 6	
Nikolski	94			83	109	97	64	92	57	50	- 12	
Unalaska	317	269	281	299	226	298	173	218	342	1,301	+280	700-3,000
Akutan	80	60		66	71	80	86	107	101	126	+ 25	200-800
East of Unimak Pass												
Nelson Lagoon									43	59	+ 37	25-45
False Pass					59	88	42	41	62	65	+ 5	120-150
Cold Bay								86(3)	256	226	- 12	
King Cove						135	162	290	283	462	+ 63	60-320
Belkofski	185	163		129	123	140	119	57	59	10	- 83	
Sand Point				60	69	99	107	254	360	619	+ 72	65-150
Squaw Harbor						79	45	75(2)	65	6	- 91	
Other 1970/1980									397	29		
Total 1970/1980									7,879	7,698	- 2	

Sources:

Primary: Jones, 1973.

Other:
(1) Alaska Department of Labor, 1981.
(2) Federal-State Land Use Planning Commission for Alaska, 1976.
(3) Alaska Consultants, 1981.
(4) Kish Tu, 1981.
(5) Don Bantz and Associates, (1977); Reed, 1981; McDowell, 1981.

uation of the voluntary population consolidation processes experienced earlier in the region. Sand Point absorbed the population of Unga, the dominant village of the Shumagin Islands until the 1940's, as well as the people of Pauloff Harbor on Unimak Island, and a majority of the population of Squaw Harbor (Jones, 1973). In the last decade, Sand Point grew by 72 percent to a population of 619, whereas Squaw Harbor was depopulated during the same period to a size of 6 in 1980, a decrease in population by 59 people (a 91 percent decrease). There has been a comparable relationship between King Cove and nearby Belkofski, although land limitations at King Cove and acculturation differences are attributed to explain the lack of complete consolidation (ibid.). King Cove grew by 63 percent during the decade of the 1970's, reaching a population of 462 in 1980. During the same period, Belkofski declined by 83 percent to a population of 10, a decline of 49 persons. Transient seasonal population is also attributed to the seafood processing functions of Sand Point and King Cove, estimated to range from 65 to 150 persons in Sand Point and 60 to 320 persons in King Cove.

False Pass, a fishing village on Unimak Island, has maintained a fairly stable population in contemporary times in excess of 50 people. On the lower Alaska Peninsula, Nelson Lagoon, also a fishing village, showed a 37 percent increase in population for the decade prior to 1970. The earliest census data available for Nelson Lagoon was for 1970, although Jones (1973) indicates the village was established in 1906. Both fishing villages have experienced the seasonal influx of migrants. Some 120 to 150 transients have been involved in the False Pass salmon fishing and cannery operations, whereas 25 to 45 inmigrants seasonally have been involved in the Nelson Lagoon salmon fishery. Cold Bay, a community primarily serving an air transportation service function, declined in population during the last decade, but population fluctuations are attributed more to changes in air transport economics than to any other factor.

b. Population Composition: Information on the composition of the population in Alaska is not available from the 1980 census. The characteristics described here are based on field reports and secondary sources, partial data from which are shown on Table III.C.1.b.-1.

Pribilof Islands: The villages of St. George and St. Paul on the Pribilof Islands are composed predominantly of Aleut people. The average size of households is comparable between the villages, averaging 4.9 persons in St. George and 5.1 in St. Paul. Heads of households are somewhat younger in St. George, with a median age of 41.0 years compared with 48.5 years in St. Paul. Recent information on St. Paul indicates there are few changes in the composition of the population since 1970, with the exception of there being a smaller proportion of the population under the age of 10 and a larger proportion of young adult males (Alaska Consultants, 1981).

West of Unimak Pass: Rapid population growth in Unalaska has produced considerable change in the composition of population since 1970. In 1970, Alaska natives comprised 63 percent or a majority of the population, whereas in 1977 this proportion was reduced to 23 percent. If transient fishing and fish processing populations were included, the Alaska native component of the 1977 population would be further reduced (ibid.). In 1970, males ages 25 to 34 accounted for 9 percent of the total population. This proportion had increased to 17 percent by 1977, assumed attributable to in-migrants responding

Table III.C.1.b.-1
Composition of the Native Population
Aleutian-Pribilof Islands Area

	Percent Native 1/	Native Households 2/		Native Heads of Households 2/		
		Number	Average Size	Median Age	Sex	
					Male	Female
St. Paul	87	82	5.1	48.5	74	8
St. George	95	31	4.9	41.0	29	2
Atka	97	17	5.1	46.5	16	1
Nikolski	97	21	2.7	51.7	19	2
Unalaska	23	38	3.4	44.0	25	13
Akutan	93	16	4.3	56.5	15	1
Nelson Lagoon	89	11	4.1	36.5	9	2
False Pass	96	9	5.3	42.0	8	1
Cold Bay	2	NA	NA	NA	NA	NA
King Cove	75	32	4.7	39.5	31	1
Belkofski	100	5	3.0	31.7	4	1
Sand Point	59	108	3.6	48.0	98	10
Squaw Harbor	NA	NA	NA	NA	NA	NA

Sources:

1/ Adapted from Don Bantz and Associates, 1977, p. 30.

2/ U.S. Army Corps of Engineers, Alaska District, 1979. Appendix I, pp. 31 and 33.

NA = Not Available

to job opportunities. In 1977, the male/female ratio in Unalaska was 59/41 percent of the total population, and 72 percent of the non-resident (transient) population was male. Asians comprised a large proportion of the transient population (ibid.). In comparison with a community of a comparable number of native households, such as King Cove, Unalaska in 1977 had a low average native household size (3.4 persons) and a high proportion (13 of 38 or 34 percent) of native female heads of households.

Native villages comprise the other communities under discussion in the Aleutians west of Unimak Pass. The composition of the population in Atka was comparable generally in 1977 with the characteristics shown for the population of the Pribilof Islands. The villages of Nikolski and Akutan showed an aging head of household characteristic (51.7 and 56.5 years, respectively), which was compounded in Nikolski with a small (2.7 persons) average household size. Field observations in 1981, however, indicate the age structure in Akutan is influenced by a reduction in the out-migration of young married adults and the return of former Akutan residents retiring after years of living elsewhere in Alaska (Kish Tu Addendum No. 3, 1981). In Nikolski, the number of adults of childbearing age is small, and a disproportionate number of the remaining older adult population are single, either through death of a spouse or divorce, which may explain the low average household size (ibid.).

East of Unimak Pass: Among the smaller villages, the population composition of False Pass in 1977 was comparable in some respects with the characteristics shown for native villages such as Atka and St. George, but differed considerably from the more nearby Nelson Lagoon. The median age of heads of households in Nelson Lagoon was younger (36.5 years) than in False Pass (42.0 years) and the average size of household appeared to indicate a more urban family composition in Nelson Lagoon (4.1 persons) than in False Pass (5.3 persons). Assuming the data are correct, the population characteristics of Belkofski, which had persisted as an economically disadvantaged village for decades, showed a relatively young rather than aging population.

The two larger villages of King Cove and Sand Point in 1977 showed considerable differences in population composition. The larger Sand Point had a population composed of 59 percent Alaska Native, whereas the King Cove proportion was 75 percent of the population. Among Native households, Sand Point was characterized by older heads of households (48.0 years compared with 39.5 years in King Cove) and a smaller average size of family (3.6 persons per household compared with 4.7 persons in King Cove). The other large community of Cold Bay had been characterized as transient, white, and predominately male (Alaska Consultants, 1981). In 1970, the composition of the population was 84 percent white and 75 percent male. More recently, the population appears to be changing to one made up largely of conventional family units (ibid.).

c. Future Environment Without the Proposal: The following discussion is a forecast through the year 2000 of anticipated growth in the Aleutian-Pribilof Islands area and in the communities of St. Paul, Unalaska, Cold Bay, King Cove, and Sand Point without the proposed lease sale. Sources of information for this discussion include: University of Alaska, Institute of Social and Economic Research (ISER), 1981, Technical Report 57; University of Alaska, ISER, 1981, St. George Sale 70 Base Case and Impact Results from the MAP and SCIMP Models; Alaska Consultants, 1981, Technical Report 59;

Management and Planning Services, 1980; City of King Cove, 1981, Community Comprehensive Plan for King Cove; and City of Sand Point, 1981, Community Comprehensive Plan for Sand Point.

The rapid expansion of the bottomfishing industry is the driving force behind future growth expectations for the Aleutian-Pribilof Islands area (Aleutian Islands Census Division) in the absence of the proposed lease sale. Based on the results of SCIMP model projections, the resident population exclusive of military personnel and civilian Federal government workers in defense-related jobs and exclusive of all defense-connected dependents is expected to increase from 3,777 in 1981 to 41,597 by the year 2000, representing an average annual rate of growth of 13.5 percent for the entire period (Univ. of Alaska, ISER, SCIMP, 1981). Over the first half of the period the population growth averages 12.5 percent, while the growth rate increases to 14.4 percent for the second half of the period. Growth of the non-military population is expected to radically change the Native/non-Native composition of the population from a baseline of 56 percent Native to 8 percent after a 20 year industrial growth period (ibid.). When considering total population, which includes military and defense-related civilian government employees and dependents plus non-resident fishing industry and construction workers, an average annual growth rate of 8.7 percent is expected over the entire period, from a total population of 10,595 in 1981 to 52,040 in 2000 (ibid.).

Pribilof Islands: Future population growth in the Pribilof Islands through the year 2000 can be divided into two aspects: growth of the traditional Aleut villages of St. Paul and St. George and growth attributed to the introduction of major new economic ventures, such as the bottomfishing industry (Alaska Consultants, 1981). Factors affecting population growth or decline in the traditional villages are expected to be those characteristic of the last decade, with cultural factors continuing to contribute to population stability despite changes in employment opportunities (ibid.). Although a new bottomfishing and processing activity is forecast for St. Paul Island, the population of the traditional village is anticipated to remain relatively stable (with little significant increase due solely to natural population increase) at a size of approximately 525 persons (ibid.). The population of St. George also is expected to remain relatively stable, with increases possibly resulting in household size as opposed to the number of households (Management and Planning Services, 1980).

The introduction of a bottomfishing industry processing plant at St. Paul by 1990 is projected to increase the population of the island by about 900 persons, representing a population increase of about 170 percent to a total of about 1,420 (Alaska Consultants, 1981). The affects of such a population increase on the traditional community is expected to depend on the manner in which the new industry is established on the island. It is assumed that a group housing enclave form of physical development would be encouraged through local city and village corporation institutions to minimize social and cultural linkages with the traditional population (ibid.).

West of Unimak Pass: Among the island communities west of Unimak Pass, Unalaska is anticipated to experience most extensively the effects of the rapid expansion of the bottomfishing industry. According to Alaska Consultants (1981), the resident population of Unalaska is projected to grow more than tenfold over the next 2 decades from about 1,300 residents in 1980 to more than 13,000 residents by 2000. This is an average annual growth rate of better than 12 percent. Approximately three-quarters of this growth is anticipated to be tied directly or indirectly to development of the bottomfishing industry. A gradual decline is assumed over the forecast period in the proportion of the total population living in group housing. This would result in an estimated two-thirds of the population living in conventional dwelling units by 2000. The future population of Unalaska is anticipated to be composed of a disproportionate number of young males and unattached adults, with relatively few older persons proportionate to the total population. The proportion of Alaska Natives to the total population in Unalaska is expected to be dramatically reduced, in as much as the majority of newcomers may be expected to originate from outside the region and outside the state (ibid.). This is not expected to be the case in the smaller, predominately Native villages of Nikolski and Akutan, whose populations are expected to be influenced by factors similar to those of the recent past.

East of Unimak Pass: East of Unimak Pass, the most significant growth in population is expected to take place in Cold Bay, King Cove, and Sand Point. Nelson Lagoon may increase in size by a limited number of households based on continued strength of the local gillnet fishery. The future of False Pass will likely hinge on the decisions of whether and what type of cannery to rebuild to replace the one destroyed by fire in 1980, coupled with the tenacity of the people to remain in False Pass (personal communication, Langdon). False Pass may experience an increase in population over the next several decades if a multi-purpose cannery is built as opposed to one built solely to process salmon. Considering past trends, such growth could be expected from migration within the region. Both communities are expected to remain predominantly Aleut and at a small-scale village size.

Cold Bay is expected to increase in population in the next 2 decades due to the establishment of a shore-based seafood processing facility for finfish and shellfish and possibly some increase in tourism (Alaska Consultants, 1981). Under these circumstances, the resident population of Cold Bay is anticipated to increase by about 400 persons between 1980 and 2000 to a total of 646 residents, nearly tripling the 1980 population (ibid.). Introduction of the seafood processing industry should tend to diversify the social and economic structure of the community, although vestiges of the existing characteristics of the population should still pertain. An increased proportion of conventional family units should be expected based on current trends.

The growth prospects for King Cove and Sand Point also hinge on the local growth and diversification of the fishing and seafood processing industries. The onshore seafood processing facility in King Cove partially destroyed by fire in 1976 was rebuilt with the capability of processing salmon, crab, and bottomfish. Capacity in this plant is expected to be increased and there is the possibility of another processing plant being built by 1990 (King Cove Comprehensive Plan, 1981). Diversification of the processing facilities existing in Sand Point is expected in the future, with an increasing emphasis on the processing of bottomfish. Expansion of the Sand Point boat harbor, begun in 1981, with a public dock capable of accommodating vessels up to 300 feet in length, and the increased capacity of the city water system provide the basis for an increased and diversified maritime livelihood (Sand Point Comprehensive Plan, 1981). Sand Point is expected to reach a population of about 1,300 by the year 2000, based on anticipated growth in the local economy and the capacity to increase available housing stock (ibid.). Based on equally hopeful economic speculation, but more constrained land and infrastructure parameters, the population of King Cove is anticipated to range from 900 to 1,000 by the year 2000 (King Cove Comprehensive Plan, 1981). The population in both communities is expected to remain as predominantly conventional family units of Aleut decent, since population growth is expected to be heavily influenced by inter-village migration within the Aleutian-Pribilof Islands region.

The population growth anticipated for the communities in the region under consideration is summarized on Table III.C.1.c.-1.

2. Subsistence Patterns: Subsistence as a cultural orientation is discussed in Section III.C.4. This discussion deals with subsistence resources used by local residents, the characteristics of the harvest, and the relation of subsistence effort to other forms of employment. The communities of Cold Bay and Atka are not included in this discussion. Little subsistence use data is available for the urban-oriented population of Cold Bay, and Atka is not expected to experience significant impacts from the proposed lease sale. Major sources for this discussion include Kish Tu Addendum No. 3 (1981), Smythe (1981), and Hayward et al. (1977).

a. Subsistence Resources: Table III.C.2.a.-1 illustrates the variety of subsistence resources used in the villages and towns potentially affected by the proposed lease sale. The biological characteristics of these resources are covered in Sections III.B.1. through III.B.4. The resources commonly used throughout the area are varieties of fish, marine mammals, birds, intertidal organisms and vegetation, and terrestrial greens and berries. Large land mammals, except for domestic sheep and reindeer, are available locally only on Unimak Island and the mainland.

Although similarities exist in the types of resources used in the area, considerable differences and variations of importance exist among communities using the resources. Salmon are a primary subsistence resource in the area except for the Pribilof Islands, where emphasis is given to the more readily available halibut. Pink and silver salmon are available to communities covered in this discussion west of Unimak Pass, whereas red, king, and silver salmon are more commonly used east of the pass. Crab is used as a subsistence resource in the larger communities of Unalaska, King Cove, and Sand Point.

Although different varieties of marine mammals are available throughout the area, they are not used for subsistence purposes to any great extent by the communities east of Unimak Pass, with the exception of King Cove and possibly the exception of Belkofski, for which subsistence data is unavailable. Fur seals are a primary subsistence resource harvested solely on the Pribilof Islands. Sea lions are also of primary importance on the Pribilof Islands and in Nikolski, and seals are used to a significant extent in Nikolski and in Akutan. Residents of the Pribilof Islands also place primary importance on a wide variety of birds and bird eggs, whereas intertidal organisms and vegetation (reef as well as beach food) are significant resources year-round in Nikolski.

Table III.C.1.c.-1
Summary of Anticipated Population Growth for Selected Communities Aleutian-Pribilof Islands Area

	1980[1]	1985	1990	1995	2000
St. Paul[2]	527	525	1,423	1,423	1,423
Unalaska[2]	1,288	2,945	6,280	10,586	13,221
Cold Bay[2]	243	332	422	531	646
King Cove[3]	684	745-810	810-975	885-1,030	965-1,080
Sand Point[4]	794	900	1,015	1,145	1,295

Sources:

1/ The data for 1980 differs somewhat but not substantially from the census data shown on Table III.C.1.-1 for St. Paul, Unalaska, and Cold Bay. The 1980 census data for King Cove was reported at 462, whereas the population of Sand Point was reported at 619. The sources of the data for King Cove and Sand Point indicate the added population in 1980 consists of cannery employees.

2/ Alaska Consultants, Technical Report 59, 1981.

3/ Community Comprehensive Plan for King Cove, 1981.

4/ Community Comprehensive Plan for Sand Point, 1981.

Table III.C.2.a.-1
Subsistence Resources Utilization
Aleutian-Pribilof Islands Area

	Fish								Inter-tidal Food	Marine Mammals			Land Mammals		Birds	Bird Eggs	Greens	Berries
	Salmon					Halibut	Shell Fish	Other Fish		Seal	Sea Lion	Fur Seal	Caribou	Moose				
	Red	King	Pink	Chum	Silver													
St. Paul						(*)		*	*	*	(*)	(*)			(*)	(*)	*	*
St. George						(*)		*	*	*	(*)	(*)			(*)	(*)	*	*
Nikolski			(*)		(*)	*		(*)	(*)	(*)	(*)				*		*	*
Unalaska			(*)		(*)	*	*	*	*	*	*				*	*	*	*
Akutan			(*)		(*)	*		*	*	(*)					*		*	*
Nelson Lagoon	(*)	(*)			(*)	*		*	*	*			(*)		*		*	*
False Pass	(*)	(*)			(*)	*		*	*	*			(*)		*		*	*
King Cove	(*)	(*)			(*)	*	*	*	*	(*)			(*)		*		*	*
Sand Point	(*)	(*)			(*)	*	*	*	*	*			(*)		*	*	*	*

(*) Denotes primary resource.

Sources:
Primary: Reed, 1981; Smythe, 1981.
Other: Bowden, 1981; McDowell, 1981; Hayward et al., 1977.

BEST DOCUMENT AVAILABLE

b. Characteristics of the Subsistence Harvest: The use of locally available resources for subsistence purposes is an annual cycle of activity based on the relationship between local need and the availability of resources. The annual subsistence catch among resources is an expression of this dynamic relationship, although regularity in the availability of certain resources is usually counted on more than for others. The ability to carry out the subsistence harvest has significant social and cultural meaning, symbolizing sociocultural continuity and stability regardless of the level of harvest.

Pribilof Islands: Figure III.C.2.b.-1 illustrates the general locations on St. Paul and St. George Islands where different subsistence resources are harvested and the seaward range of such activities. The fur seal harvest takes place on St. Paul Island generally during the month of July. Commercial sealing was terminated on St. George Island in 1972 by the National Marine Fisheries Service (NMFS). In 1980, about 26,000 fur seals were harvested on St. Paul for commercial purposes, administered by NMFS, whereas the residents of St. George were limited to a subsistence catch of 350 fur seals. Village people on St. Paul take what they need of meat during the commercial harvest. Efforts to transport fur seal meat to St. George from St. Paul have been unsatisfactory to St. George residents, who indicate the 350 limit is inadequate (Smythe, 1981).

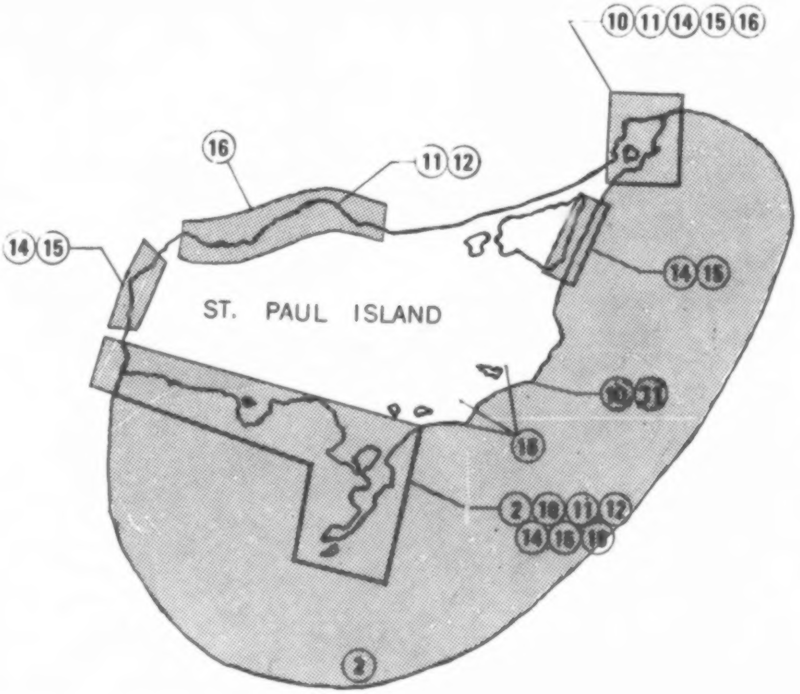
Halibut is fished from mid-May through October. Fishermen operating from skiffs stay within a half-mile of the shore on St. George and may venture 4 to 5 miles from shore on St. Paul. Halibut is stored throughout the winter and is most important during Lent, when the Orthodox Church prohibits the eating of meat. Other fish (cod, sculpin, flounder, rockfish) may be caught while people are fishing for halibut. Salmon is not easily available on the Pribilof Islands, which underscores the importance of halibut. Occasionally halibut/salmon trades take place with mainland residents. Dried fish is considered a delicacy on the Pribilof Islands. Nikolski and the Pribilof Islands people often exchange dried fish for seal and sea lion meat (Kish Tu Addendum No. 3, 1981).

Sea lions are hunted mainly during the winter from the shoreline where a great deal of skill is needed to assure landing the mammal, which may weigh from 800 to 1,200 pounds. Landed sea lions are distributed among the hunting party and then among other households. There does not seem to be a readily available substitute for sea lion on the Islands (Smythe, 1981). Birds and bird eggs are additionally important in the subsistence cycle, perhaps moreso on St. George than St. Paul due to their greater abundance there (ibid.).

On both islands, subsistence activities are carried out in conjunction with other forms of employment. Few, if any, island residents regularly travel elsewhere to obtain seasonal employment. Hunters who are regularly employed engage in subsistence activities at the end of the workday and on weekends. Others, between seasonal jobs, may spend more time in such pursuits (ibid.).

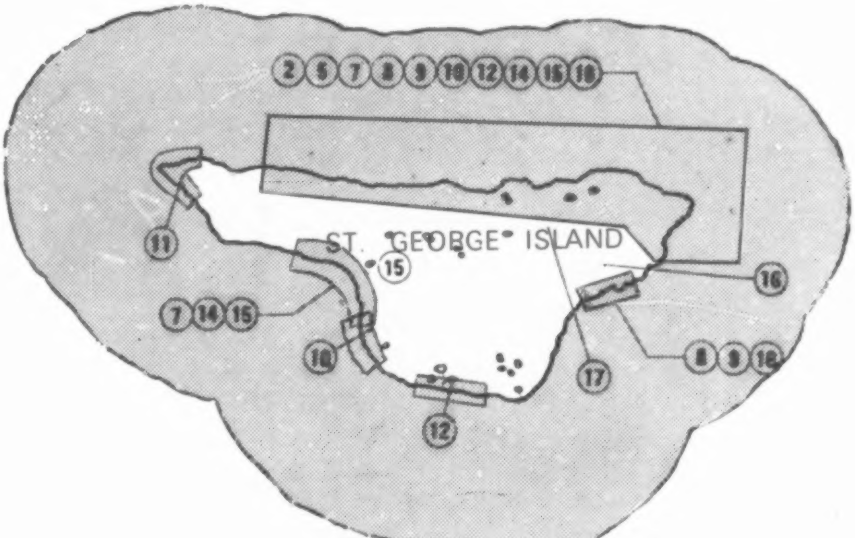
West of Unimak Pass: Figure III.C.2.b.-2 shows the general range of movement needed to carry out subsistence harvest activities in Nikolski, Unalaska, and Akutan. Similarities in the resource base of these communities, as previously discussed, contribute to similarities in the seasonal subsistence effort by the type of species. Pink salmon (and a few silvers) are caught during the

Figure III.C.2.b.-1


10 11 14 15 16
16
11 12
14 15
ST. PAUL ISLAND
14 15
10 11
16
2 10 11 12
14 15 16
2

- 1 SALMON
- 2 HALIBUT
- 3 TROUT
- 4 SHRIMP
- 5 HAIR CRAB
- 6 CLAMS
- 7 INTERTIDAL FOOD
- 8 SEA MAMMALS
- 9 SEALS
- 10 FUR SEALS
- 11 SEA LIONS
- 12 HAIR SEALS
- 13 CARIBOU
- 14 BIRDS
- 15 BIRD EGGS
- 16 DUCKS, GEESE
- 17 BERRIES, GREENS

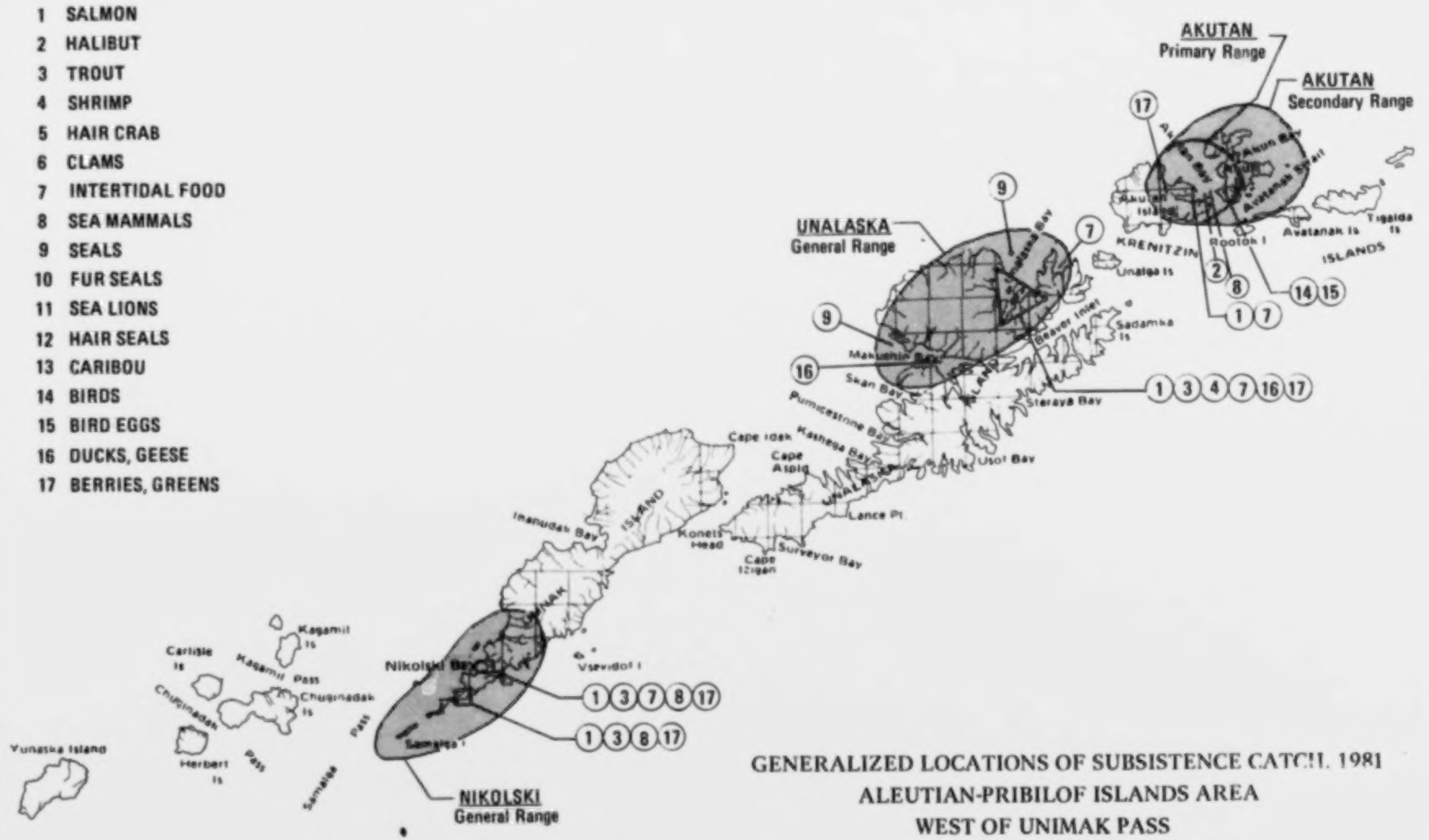
GENERALIZED LOCATIONS OF SUBSISTENCE CATCH, 1981
ALEUTIAN–PRIBILOF ISLANDS AREA
PRIBILOF ISLANDS


2 5 7 8 9 10 12 14 15 16
11
ST. GEORGE ISLAND
15
7 14 15
16
10
17
8 9 16
12

Source: Smythe, 1981.

BEST DOCUMENT AVAILABLE

Figure III.C.2.b.-2


1 SALMON
2 HALIBUT
3 TROUT
4 SHRIMP
5 HAIR CRAB
6 CLAMS
7 INTERTIDAL FOOD
8 SEA MAMMALS
9 SEALS
10 FUR SEALS
11 SEA LIONS
12 HAIR SEALS
13 CARIBOU
14 BIRDS
15 BIRD EGGS
16 DUCKS, GEESE
17 BERRIES, GREENS
AKUTAN
Primary Range
AKUTAN
Secondary Range
⑰
Akun Bay
Akutan Island
Avatanak Strait
Rootok I
Avatanak Is
Tigalda Is
KRENITZIN
ISLANDS
②
⑧
⑭⑮
①⑦
⑨
UNALASKA
General Range
⑦
Unalga Is
⑨
Sedanka Is
Beaver Inlet
⑯
Makushin Bay
Skan Bay
①③④⑦⑯⑰
Sturaya Bay
Pumicestone Bay
Kashega Bay
Cape Idak
Cape Aspid
Usof Bay
UNALASKA
Lance Pt.
Inanudak Bay
ISLAND
Konets Head
Cape Izigan
Surveyor Bay
UMNAK
Kagamil Is
Carlisle Is
Kagamil Pass
Chuginadak Is
Chuginadak
Pass
Herbert Is
Pass
Samalga
Nikolski Bay
Vsevidof I
①③⑦⑧⑰
①③⑧⑰
Samalga I
Yunaska Island
NIKOLSKI
General Range

GENERALIZED LOCATIONS OF SUBSISTENCE CATCH, 1981
ALEUTIAN-PRIBILOF ISLANDS AREA
WEST OF UNIMAK PASS

Source: Kish Tu Addendum No. 3, 1981

summer months largely with beach seines operated from skiffs and by hand lines. Ducks and geese are hunted in the spring and fall, berries and greens are gathered in the spring and summer, and beach foods (intertidal organisms and vegetation) are gathered as needed to add variety to the diet. Fresh fish are eaten throughout much of the summer. Families put up salmon for winter by different methods and in quantities depending on family size, ranging from 100 to 200 in Unalaska and 200 to 300 in Nikolski per family (Kish Tu Addendum No. 3, 1981). Salmon is mostly frozen in Unalaska, smoked, dried, or salted in Akutan (the electrical power system is not sufficient to operate freezers), and frozen, salted, or smoked in Nikolski (ibid.). The sharing of resources, especially with those who cannot provide for themselves, is a common characteristic of the subsistence harvest in this area as elsewhere.

While similarities in the characteristics of the subsistence harvest are attributable to a common resource base, major differences in the subsistence harvest are probably attributable to the different character of each community. Nikolski is an isolated, traditional Aleut village with no significant local income source. Whatever income is derived from wages earned elsewhere, social security and other retirement income, or transfer payments are used largely for the necessities of fuel, electricity, clothing, basic food stuffs, and subsistence technology. Almost all meat consumed locally is caught locally, with the character of the subsistence harvest that of a community undertaking overseen by senior hunters. Subsistence livelihood in Nikolski is facilitated by the abundance and easy access to local resources for the elderly as well as the young.

Akutan, an Aleut village about twice the size of Nikolski, is isolated geographically but has had a long history of locally available wage employment provided by the external economy. As Spaulding (1980) documents, the village underwent dramatic change in the decades between 1953 and 1976. Consequences included a decline of subsistence resources and a growing family dependency on wage labor. Examples of some effects of this on the subsistence harvest are documented in Kish Tu Addendum No.3 (1981). Subsistence activities have become a major responsibility of the young, such as high school boys and recent high school graduates not yet employed, since much of the young adult population of Akutan is preoccupied with wage employment either in the village or elsewhere. Cod, once caught locally, are now more commonly acquired from the trawlers that frequent Akutan Bay. Whereas approximately 80 percent of the food consumed in 1953 was derived from subsistence activities, scarcity of subsistence resources, combined with other factors, by 1976 made the people of Akutan almost totally dependent on wages with which to purchase commercially produced foods (Spauling, 1980). Although Kish Tu Addendum No. 3 (1981) documents subsistence patterns extant in Akutan in 1981, no comparison is provided with previous years to determine relative differences in the level of effort or the extent to which the harvest met local needs.

Unalaska has grown in a relatively short period of time from a village to a booming frontier town. What had been the Aleut village geographically and socially remains however. For the town in general, the subsistence harvest is characterized as a means of enhancing the quality of life, being able to get outdoors and harvest resources in conjunction with wage labor. Fishing is the principle subsistence activity, undertaken by families and groups of friends, and sometimes associated with an all day recreational outing. Other subsistence resources--mushrooms, shellfish, seals, trout--are exploited at various times of the year to acquire a limited quantity of food to add variety or special items to the diet (Kish Tu Addendum No. 3, 1981). The primary orientation of the community as a whole, however, is toward other forms of work, a characteristic shared by the residents of the Native village as well. According to Jones (1969), the introduction of crab processing work in the community in the early 1960's changed subsistence patterns appreciably.

"(sic) Before the crab era the Aleut exercised a certain degree of control over his economic activities. He could estimate the probable duration of work and amount of earnings during the sealing season at the Pribilofs. If he encountered a slow season in salmon fishing or canning in the autumn, he would seek other employment or return to the village for subsistence fishing. But once having chosen to work at the crab plants, he must remain available at all times." (Jones, 1969, pp. 68-69)

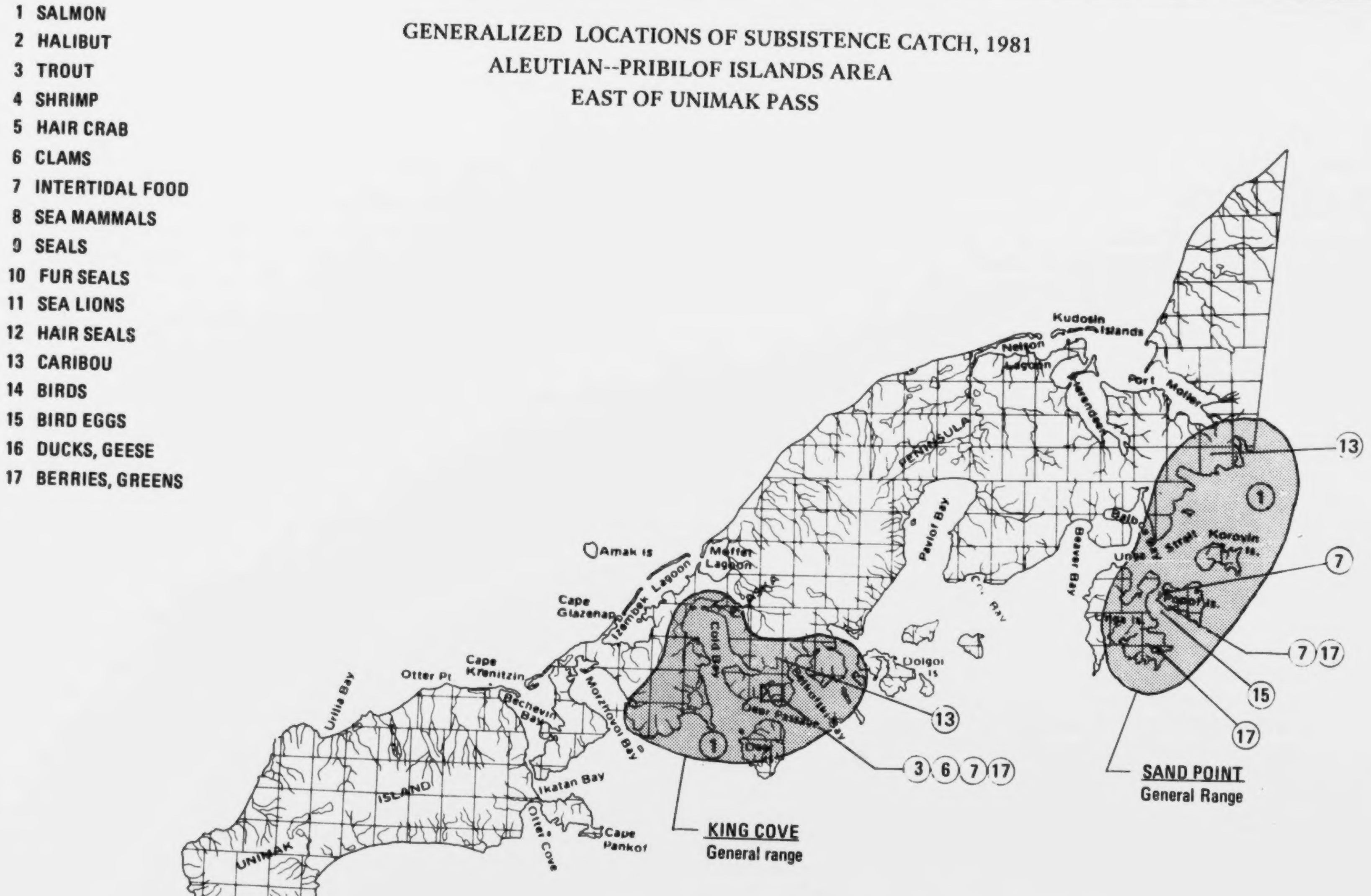
Working in the crab processing plants, which offered irregular and unpredictable amounts of work, required the individual's full presence in town, a situation which mitigated against a substantial amount of subsistence activity at that time. The types and quality of work available to Native village residents may have changed in the post-Alaska Native Claims Settlement Act era since 1971. However, the likelihood exists that a similar pattern exists today, as implied by the field observations found in Kish Tu Addendum No. 3 (1981).

East of Unimak Pass: The smaller villages of Nelson Lagoon and False Pass and the larger villages of King Cove and Sand Point, all of which are oriented toward commercial fishing, represent more similarities than differences in the characteristics of the subsistence harvest and more positive integration of such activities with other work than seen earlier. This is especially true in King Cove and Sand Point, where the nature of both their work (fishing) allows the time needed and provides the equipment to gain access to a variety of subsistence resources. The general range of mobility used to perform the subsistence harvest and the types of locations where harvests take place are shown on Figure III.C.2.b.-3 for King Cove and Sand Point. Such mapped data is not available for Nelson Lagoon and False Pass.

As with the communities previously discussed, a commonality in the types of subsistence resources available produces comparable types of subsistence resource use. Salmon (king, red, and silver) and caribou are the primary subsistence resources. Although the pattern varies, salmon for subsistence purposes generally are taken with the same gear used for commercial fishing or may be taken from the commercial catch itself. In King Cove, king and red salmon are saved from the commercial catch, whereas silvers are caught locally for subsistence after the commercial fishing season. King salmon are retained from commercial nets on Sand Point vessels, with such vessels used after the commercial season to catch red and silver salmon with half purse seines (Kish Tu Addendum No. 3, 1981). The set gillnet sites in Nelson Lagoon, operated largely by the wives and children of commercial vessel owners, are used after the commercial season for subsistence fishing. In False Pass, subsistence salmon are obtained from two beach seine sites and from the commercial drift gillnet vessels (Kish Tu Addendum No. 1, 1981). Those fishermen from King Cove and Sand Point who convert to crab fishing gear in the winter retain for personal use the crab caught too late to sell at the close of the commercial season (Kish Tu Addendum No. 3, 1981).

Figure III.C.2.b.–3

GENERALIZED LOCATIONS OF SUBSISTENCE CATCH, 1981
ALEUTIAN--PRIBILOF ISLANDS AREA
EAST OF UNIMAK PASS


1 SALMON
2 HALIBUT
3 TROUT
4 SHRIMP
5 HAIR CRAB
6 CLAMS
7 INTERTIDAL FOOD
8 SEA MAMMALS
9 SEALS
10 FUR SEALS
11 SEA LIONS
12 HAIR SEALS
13 CARIBOU
14 BIRDS
15 BIRD EGGS
16 DUCKS, GEESE
17 BERRIES, GREENS
Kudosin Islands
Nelson Lagoon
Herendeen
Port Moller
PENINSULA
Pavlof Bay
Balboa
Unga Strait
Korovin Is.
Unga
Popof Is.
Beaver Bay
Dolgoi Is
Amak Is
Moffet Lagoon
Izembek Lagoon
Cape Glazenap
Cold Bay
Deer Is.
Cape Krenitzin
Otter Pt
Urilia Bay
Bechevin Bay
Morzhovoi Bay
Ikatan Bay
Otter Cove
Cape Pankof
UNIMAK
ISLAND
1
13
7
7 17
15
17
13
3 6 7 17
KING COVE
General range
SAND POINT
General Range

Source: Kish Tu Addendum No. 3, 1981.

BEST DOCUMENT AVAILABLE

Caribou generally are hunted from early fall to spring, depending on local game unit regulations. The fall caribou hunt in Sand Point takes place on the mainland, reached by using the family commercial fishing vessel. People from King Cove already on the mainland hunt behind the village or use their fishing vessels to range within a 50 mile radius of the village. A family in King Cove normally would use three to four caribou during the winter (Kish Tu Addendum No. 3, 1981). Seals are also hunted during the winter from the family vessel. Residents of False Pass hunt caribou in areas inland from the village, whereas caribou hunting from Nelson Lagoon takes place on the Caribou-Sapsuck River drainages, reached primarily by skiff (Hayward et al., 1977). Other commonalities of the subsistence harvest include the hunting of ducks and geese, the use of intertidal organisms and vegetation, and the gathering of greens and berries in season.

c. Future Environment Without the Proposal: The patterns and characteristics of subsistence practices for the villages east of Unimak Pass should remain relatively unchanged during the foreseeable future. Elsewhere in the region, St. Paul and Unalaska are more susceptible to change in terms of the availability of and access to subsistence resources and in the relationship of subsistence practices to other forms of employment.

The construction of a bottomfish processing plant on St. Paul Island by 1990, offers the prospect for localized habitat reduction, and the increased population needed to operate the plant likewise increases the likelihood for increased harvest pressure on subsistence resources. However, the likelihood of such prospects reaching significant proportions is extremely low, considering the richness of the resources and the existing management authorities vested with the Tanadgusix (St. Paul village) Corporation as land owner and the National Marine Fisheries Service as wildlife refuge manager. A more likely prospect for initiating change in subsistence lies in the absorption of heretofore underemployed Aleuts into bottomfishing and processing operations. Assuming continuation of the commercial fur seal harvest and continued management of the species by the NMFS, the addition of new jobs would tend to intensify the job orientation existing currently among St. Paul residents, meaning that subsistence hunting and fishing would become more of a weekend or after-hours pursuit. The effects on subsistence are more speculative, however, given the condition where bottomfishing and processing may substitute for the commercial fur seal harvest and attendent NMFS management hiring. In this case, St. Paul residents may have to attempt to substitute other local resources or pay for imported meat to the extent to that fur seal meat previously had met local subsistence needs. This could be true even with the establishment of a subsistence catch quota, as currently the case on St. George Island, and could lead to increased dependency on earned income to compensate for reduced subsistence resources.

The centering of bottomfish industry growth in Unalaska presents the more dramatic potential for effects on subsistence. Aleut subsistence had already undergone considerable change with the advent of crab processing in the community. A tenfold increase in population over 2 decades and the solidification of a more family-oriented form of residency presents the potential to accentuate and intensify the urban orientation to subsistence (individualistic and nuclear family oriented) that presently exists generally in Unalaska. With the construction of facilities and social infrastructure to accommodate the growth, there is the potential for the reduction of local habitat for supporting existing local subsistence resources. An increased local subsistence demand by the larger population also could cause the need for increased harvest regulation, especially if resources are affected by other causes. The combined effect of increased population pressures and reduced local resources could present the need for added income to provide the mobility to substitute resources from elsewhere, if available. For those residents unable or unwilling to gain access to opportunities provided by the rapid growth, the need for added income could result in unmet subsistence needs to the extent that added mobility would be required to procure subsistence resources. The result could mean an increased dependency on wage and other forms of income to purchase subsistence substitutes in a local economy superheated moreso than in the past.

3. Fishing Village Livelihood: The purpose of this section is to draw a relationship between commercial fishing as a form of livelihood and the residents of the permanent fishing villages found in the area. Although a variety of commercial fisheries may be used as the basis for village livelihood, salmon fisheries are used here as indicative of the common history of a large segment of the area (see Sec. III.B.1.a. for discussion of commercial fisheries). As a consequence, the focus is on the Alaska Peninsula and Shumagin Islands with the villages of Nelson Lagoon, False Pass, King Cove, and Sand Point.

A review of the 1978 commercial fishing limited entry permit data on Table III.C.3.-1 shows that salmon fishing elsewhere in the area was limited or non-existent. Only 8 percent of the permits owned by persons claiming residence in Unalaska/Dutch Harbor were for salmon fishing, comprising 8 permits out of a total of 126 owned among 73 permit holders. (Unalaska salmon fishing purse seine vessels have tendered during the False Pass red salmon runs and/or may concentrate on the pink salmon runs in Makushin Bay and Unalaska Bay (Kish Tu Addendum No. 1, 1981).) No salmon fishing emanates from Akutan, although some residents have crewed vessels from other Alaskan ports (ibid.). A total of 16 limited entry permits were owned by 10 persons claiming residence in Akutan, none of which were for salmon fishing. (This does not mean that salmon fishing had not been a form of livelihood for Akutan residents prior to limited entry.) All of the permits attributed to Cold Bay residents were for salmon fishing, but the total number of permits (4) and permit holders (2) indicates such fishing does not comprise a principal source of economic livelihood for the resident population.

a. Summer Fishing Villages: The residents of the villages of Nelson Lagoon and False Pass commercial fish primarily in the summertime only. For the most part, salmon is harvested. As indicated by the 1978 permit data, all permits owned in Nelson Lagoon were for salmon fishing; whereas, in False Pass, 82 percent (27 of 33) of the permits owned were for salmon fishing. The emphasis in permit ownership in Nelson Lagoon was in drift gillnet (43 percent) and set gillnet (49 percent) gear. Purse seine permits comprised 8 percent (3) of the permits owned in Nelson Lagoon and 30 percent (8) of those owned in False Pass. The remainder of the permits owned in False Pass were for drift gillnet (40 percent) and set gillnet (30 percent) fishing. All of the permits owned in Nelson Lagoon and False Pass were for the Alaska Peninsula-Aleutian Islands management area, which extends westward from a point

Table III.C.3.-1
Commercial Fisheries Entry Commission
Permits and Permit Holders, 1978, by Gear Type

Community	1980 Population	Permit Holders	Total Permits	Total Salmon		Purse Seine		Drift Gillnet		Set Gillnet	
				Number	Percent	Number	Percent	Number	Percent	Number	Percent
Unalaska/ Dutch Harbor	1,301	73	126	8	8	6		2			
Akutan	126	10	16	0							
Cold Bay	226	2	4	4							
Nelson Lagoon (Port Moller)	59	23	39	39	100	3	8	17	43	19	49
False Pass	65	12	33	27	82	8	30	11	40	8	30
King Cove	462	55	154	91	59	38	42	40	44	13	14
Sand Point	619	112	301	140	47	59*	43	33*	24	45*	33

*Based on 137 permits for the Alaska Peninsula-Aleutian Islands area.

Source: Earl Combs, Inc., 1981.

between the Cinder and Meshik Rivers on the north Peninsula and Kupreanof Point on the south Peninsula. No Bristol Bay management area permits were owned in either of these villages in 1978.

Although the population and number of households are fairly comparable (see Table III.C.1.b.-1), there are significant differences in permit ownership and utilization between Nelson Lagoon and False Pass. There are almost twice as many permit holders in Nelson Lagoon (23) than in False Pass (12). There are also twice as many set gillnet permits owned in Nelson Lagoon as in False Pass. An explanation for this is that both heads of households and family members commercially fish in Nelson Lagoon by drift and set gillnet (see salmon catch patterns), respectively. Vessel owners in False Pass may have as many as three different types of permits (personal communication, Langdon). Wives and teenagers in False Pass customarily have worked in the cannery. There is no cannery in Nelson Lagoon, and the False Pass cannery was destroyed by fire in the winter of 1980.

The local gillnet fishery near Nelson Lagoon has been managed by the state to provide a competitive advantage for fishermen customarily fishing the area (personal communication, Bowden). The size of the catch in the last decade has allowed local fishermen to invest in efficient, productive gillnet vessels (Kish Tu Addendum No. 1, 1981). Fishing, as a form of livelihood in False Pass, has been fairly successful in the last few years (personal communication, Langdon) in a fishery that has a long established history. The False Pass fishery dates from the establishment of the first cannery at Ikatan in 1916, which was later moved to False Pass in 1928 (Jones, 1973). The majority of the fishing vessels in False Pass have evolved to be shallow draft "pocket" purse seine vessels capable of purse seine and drift gillnet operations. This type of vessel is unique in the area and is designed primarily to be used in the shallow waters of Izembek Lagoon (personal communication, Langdon).

b. Year-Round Fishing Villages: The larger fishing villages of King Cove and Sand Point engage in fishing and onshore processing activities in season year-round. Village livelihood has been based largely on salmon, crab, and shrimp in the recent past. As indicated by the 1978 permit data, there were 55 holders of 154 permits in King Cove, 59 percent of which (91) were for salmon fishing. Sand Point had 112 holders of 301 permits, 47 percent of which (140) were for salmon fishing. Drift gillnet (44 percent) and purse seine (42 percent) gear were the major categories of permits owned by individuals claiming residence in King Cove, whereas the majority of permits attributed to Sand Point residents (based on 137 permits) were for purse seine (43 percent) and set gillnet (45 percent) operations. With the exception of two Bristol Bay and one Chignik management area permits owned in Sand Point, all other permits in 1978 were for the Alaska Peninsula-Aleutian Islands management area.

The year-round fishing livelihood of King Cove and Sand Point is based on significant effort in the summer salmon fisheries (and limited effort in the halibut fisheries when seasons do not overlap) and in the fall and winter king and tanner crab fisheries. As may be expected from the differences in gear type permits attributed to each of these large villages, drift gillnet fishing vessels (ranging in length from 28-35 ft) are the largest part of the King Cove resident fishing fleet, whereas purse seine and crab fishing vessels (ranging in length from 38-65+ ft) dominate the Sand Point resident fishing fleet (Kish Tu Addendum No. 1, 1981). Many of the vessels active in king and tanner crab fisheries are also employed in summer salmon purse seine fishing, with the bulk of these total operations taking place south of the Alaska Peninsula rather than within Bering Sea waters (ibid.). Set gillnet salmon operations, which are a major element of the Sand Point fishing effort, take place largely on the south Alaska Peninsula in Stepovak and Balboa Bays and in the Shumagin Islands (ibid.).

c. Salmon Fishing Patterns: As indicated earlier, most all fishing effort initiated by the resident fleets of the four villages under consideration takes place in the Alaska Peninsula-Aleutian Islands management area. The patterns of such fishing exhibit degrees of variety and constancy over time depending on a variety of factors, not the least of which are characteristics of the species and local management practices. The patterns of salmon fishing probably show the greatest degree of constancy, although these will vary annually depending on the strength of particular salmon runs.

Table III.C.3.c.-1 summarizes the residency of initial permanent commercial salmon fishing permit holders in the Alaska Peninsula-Aleutian Islands management area. (This data was gathered in 1979 and does not reflect the subsequent sale or transfer of such permits.) Based on this data, 75 percent of the permit holders were classified as local rural Alaska residents, a large (but indetermineable) proportion of whom are assumed to reside within the management area. (No comparison can be made with the permit data shown on Table III.C.3.-1.) Such residents comprise more than 80 percent of the purse seine and set gillnet permit holders, whereas almost 40 percent of the drift gillnet permit holders were either non-residents of Alaska or non-local urban Alaska residents. The types of salmon fishing gear were about equally distributed among local rural Alaska residents. Among non-residents, 68 percent were holders of drift gillnet permits. Non-local urban Alaska residents were holders primarily of drift and set gillnet permits.

The Alaska Peninsula-Aleutian Islands management area is divided for statistical purposes to include the north peninsula, south peninsula and Aleutian Islands, divided at Unimak Pass. The catch in terms of tonnage for the south peninsula historically has been the largest, dominated by pink salmon and followed to a lesser extent by red and chum salmon. The catch in the north peninsula area has been much less, with red salmon consisting of the largest portion of the catch, followed by silver and king salmon. The catch in the Aleutians is predominantly of pink salmon and has shown considerable variation over the recent past (see Alaska Dept. of Fish and Game, 1978).

Using 1978 catch statistics as illustration, Table III.C.3.c.-2 shows the relative salmon catch for the north and south peninsula areas by gear type. As a combined area, 74 percent of the catch was attributed to purse seine effort. Of the purse seine catch, 89 percent was attributed to the south peninsula area. Almost two-thirds of the drift and set gillnet catch was attributed to the north side of the peninsula. Of the total catch attributed to the north peninsula, 67 percent was by (drift and set) gillnet. In the south peninsula area, 88 percent of the total catch was by purse seine.

The geography of the 1978 salmon catch is shown on Figure III.C.3.c.-1, which indicates the areas responsible for 92 percent of the total catch on the north peninsula and 94 percent of the total catch on the south peninsula side. This

Table III.C.3.c.-1
Residency of Initial Permanent Permit Holders
Alaska Peninsula-Aleutian Islands Management Area
(August 20, 1979)

	Purse Seine		Drift Gillnet		Set Gillnet		Total Permit Holders	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Non-resident	14	12	44	28	7	6	65	17
Alaska Resident, Rural, Local	100	85	95	61	92	84	287	75
Alaska Resident, Urban, Non-Local	3	3	17	11	11	10	31	8
Total	117	100	156	100	110	100	383	100

	Non-Resident		Alaska Resident Rural, Local		Alaska Resident Urban, Non-Local		Total Permit Holders	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Purse Seine	14	21	100	35	3	10	117	30
Drift Gillnet	44	68	95	33	17	55	156	41
Set Gillnet	7	11	92	32	11	35	110	29
Total	65	100	287	100	31	100	383	100

Source: Langdon, 1980.

Table III.C.3.c.-2
Annual Salmon Catch in Metric Tons by Gear
Type, 1978, North and South Alaska Peninsula

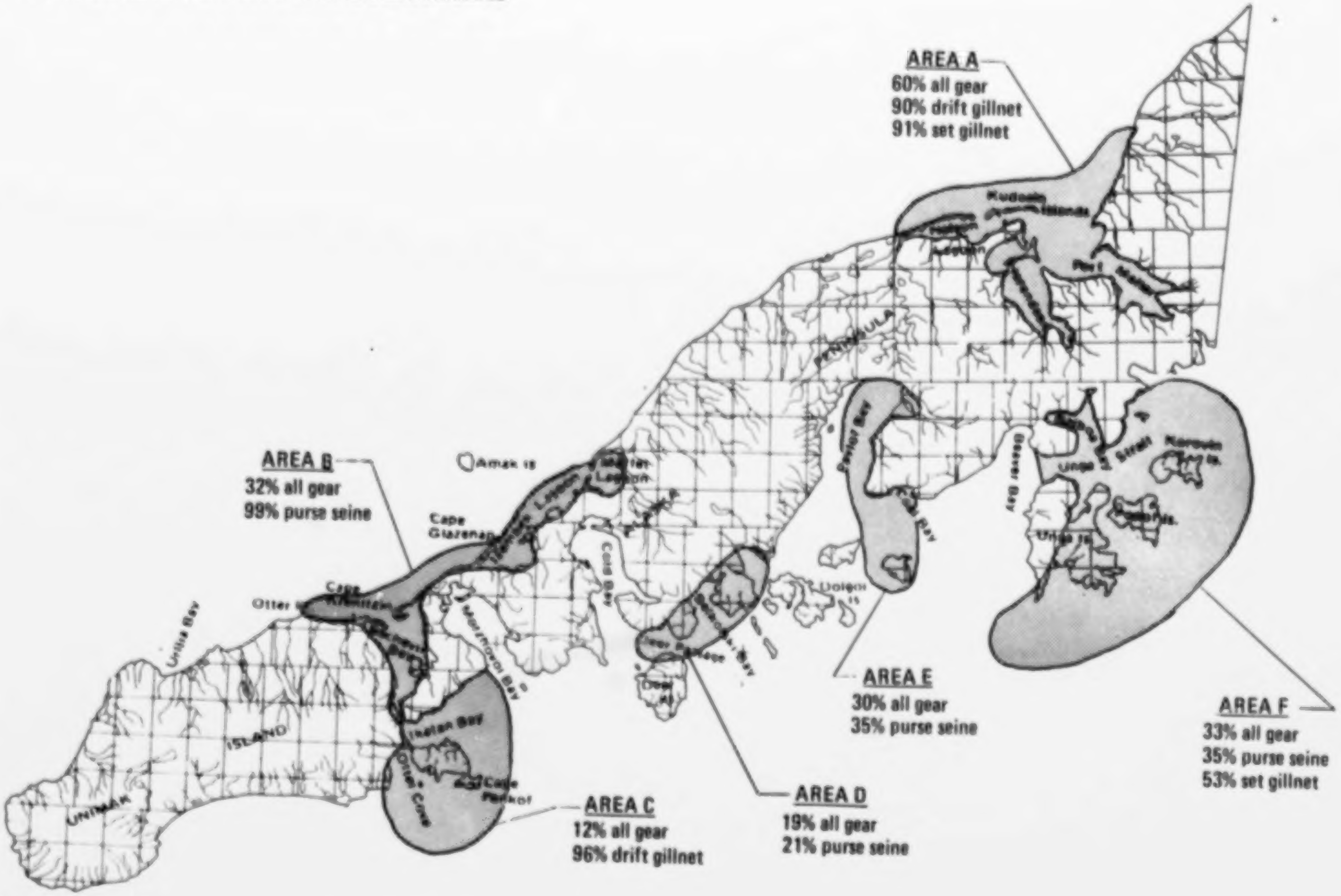
	North Peninsula		South Peninsula		Total	
	Number	Percent	Number	Percent	Number	Percent
Purse Seine	1,369	33	10,694	88	12,063	74
Drift Gillnet	2,269	55	1,164	10	3,433	21
Set Gillnet	505	12	271	2	776	5
Total	4,143	100	12,129	100	16,272	100

	Purse Seine		Drift Gillnet		Set Gillnet		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
North Peninsula	1,369	11	2,269	66	505	65	4,143	25
South Peninsula	10,694	89	1,164	34	271	35	12,129	75
Total	12,063	100	3,433	100	776	100	16,272	100

Source: Adopted from personal communication, Earl Combs, Inc., 1981.

Figure III.C.3.c.-1

PREDOMINANT AREAS OF ANNUAL SALMON CATCH, 1978
NORTH AND SOUTH PENINSULA AREAS


Kudobin Islands
Port Moller
PENINSULA
Pavlof Bay
Beaver Bay
Unga Strait
Korovin Is.
Popof Is.
Unga Is.
Dolgoi Is.
Amak Is.
Nelson Lagoon
Izembek Lagoon
Cape Glazenap
Cold Bay
Cape Krenitzin
Otter Is.
Urilia Bay
Morzhovoi Bay
Ikatan Bay
Otter Cove
Cape Pankof
Deer Is.
UNIMAK
ISLAND

AREA A
60% all gear
90% drift gillnet
91% set gillnet

AREA B
32% all gear
99% purse seine

AREA C
12% all gear
96% drift gillnet

AREA D
19% all gear
21% purse seine

AREA E
30% all gear
35% purse seine

AREA F
33% all gear
35% purse seine
53% set gillnet

Source: Earl Combs, Inc., 1981

display is based on the catch data by Alaska Department of Fish and Game statistical area and gear type shown on Tables III.C.3.c.-3 and 4. The map shows the north peninsula was divided into two distinct catch areas, whereas major fishing effort was spread among four areas on the south side of the peninsula and in the Shumagin Islands. On the north side, purse seine fishing was essentially confined to the Bechevin Bay/Izembek Lagoon area (area B), which accounted for 99 percent of the northern purse seine catch, whereas northern gillnet effort (90-91 percent of the catch) was attributed to the Nelson Lagoon/Port Moller/Bear River drainage systems area (area A). On the south side, the catch area near False Pass (area C) accounted for only 12 percent of the south side catch but 96 percent of the southern drift gillnet catch. Area D, near King Cove and Belkofski, and area E, representing catch primarily from Pavlof and Canoe Bays, accounted for 49 percent of the total catch and 56 percent of the purse seine catch in the southern area. The Shumagin Islands area and Balboa and Stepovak Bays (area F) contributed 33 percent of the total southern catch, 35 percent of the purse seine catch and 53 percent of the set gillnet catch.

d. Future Environment Without the Proposal: The prospects for growth through increased capacity and diversification of the seafoods industry are discussed as the basis for population growth in Section III.C.1.c.

4. Sociocultural Systems: The purpose of this section is to provide a profile of the existing sociocultural systems characterizing the Aleutian-Pribilof Islands region. This profile examines and attempts to document the significant elements of cultural values and orientations found in this region. The discussion is based on a literature review of cultural values and orientation conducted through the Alaska OCS Office's Socioeconomic Studies Program (SESP) (Kish Tu Addendum No. 2, 1981), field research on the Pribilof Islands by the Alaska OCS Office staff (Smythe, 1981), and other sources as appropriate. The material covered is organized under the following topics: (1) subsistence orientation, (2) cultural constructs, (3) kinship and social organization, (4) influence of the Orthodox Church, and (5) intraregional differences. Although sociocultural systems are segmented for analysis purposes, the totality of such systems for a people is the means of identifying, organizing, and explaining what is important in the environment around them. These are not static systems, but they represent a dynamic between stabilizing, patterning forces, and forces of change, which are construed as derived primarily from the external environment.

a. Subsistence Orientation: The environment of the Aleutian-Pribilof Islands region shaped the unique maritime hunting and fishing subsistence livelihood of the early Aleut, the skills and knowledge for which were shaped by social and cultural systems of organization and behavior. Since these early times, new technologies, opportunities for employment, modern education, and changing political and economic situations have altered life and brought considerable change to the area. Although many aspects of the dominant non-native culture have been adopted, most of these people still have strong cultural ties with the subsistence way of life.

Hunting, fishing, and gathering are still crucial to the Aleut cultural experience. Family patterns, sex and age roles, community organization, leadership, and social life still continue to be greatly influenced by subsistence

Table III.C.3.c.-3

Annual Salmon Catch in Metric Tons by Gear Type, by 5-Digit Statistical Area, 1978, North Alaska Peninsula

	Purse Seine		Drift Gillnet		Set Gillnet		All Gear	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
311-10								
-20								
-52	203	15					203	5
-60	794	58			3	1	797	19
312-20	132	10					132	3
-40	224	16					224	5
313-30			382	17	386	76	768	18
314-12			86	4	22	5	108	3
-20	16	1	1				17	1
-30			2		52	10	54	1
315-10			133	6			133	3
-11			1,429	63			1,429	34
316-10			70	3			70	2
-20			22	1			22	1
317-20			119	5	35	7	154	4
318-20			25	1	7	1	32	1
Total	1,369	100	2,269	100	505	100	4,143	100
Percent of Total	33		55		12			

Source: Earl Combs, Inc., 1981.

Table III.C.3.c.-4
Annual Salmon Catch in Metric Tons by Gear Type, by 5-Digit Statistical Area, 1978, South Alaska Peninsula
(Statistical Areas with Total Catch Greater than 50 Metric Tons)

	Purse Seine		Drift Gillnet		Set Gillnet		All Gear	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
281-20	218	2			6	2	224	2
-34	166	2			51	19	217	2
-35	92	1			43	16	135	1
282-10	471	4			40	15	511	4
-11	2,140	20			41	15	2,181	18
-12	259	2			11	4	270	2
283-31	81	1					81	1
-33	1,422	13					1,422	12
-42	640	6					640	5
-52	203	2					203	2
-62	404	4			10	4	414	3
-63	1,626	15			*		1,626	13
-64	1,688	16					1,688	14
-80	204	2			35	13	239	2
-90	553	5			10	4	563	5
284-50	61	1	197	17			258	2
-60	296	3	923	79	7	3	1,226	10
Total**	10,694		1,164		271		12,129	
Percent of Total	88		10		2			

*Less than 1 metric ton.

**Total for all statistical areas, regardless of catch size.

Source: Earl Combs, Inc., 1981.

requirements and the resources of the maritime environment. Many village people continue to acquire a substantial portion of their livelihood from the environment and prefer to do so (see Kish Tu Addendum No. 3, 1981).

Subsistence orientation, however, is not simply an economic result of hunting, fishing, and gathering. It is an orientation to life and one's physical and spiritual place in the natural environment. For the traditional Aleut, the environment is both a supernatural and natural entity. It has a consciousness and is filled with spiritual powers associated with its living and non-living entities. A person's interactions with the environment are governed by a moral code rather than by simple pragmatic concerns. This code prohibits the wasting of natural resources, and endorses a respectful behavior toward natural things. People assure both their physical and spiritual well-being by maintaining a proper balance with the environment itself. (For a somewhat different perspective, see Simenstad et al. 1978.)

When considering subsistence, it is crucial to remember that it is a life built on alternatives, strategies, and flexibility. It is necessary to understand the relationship of a subsistence oriented people to all of their potential resources. Nature is rarely, if ever, in a state of equilibrium or static balance. Persons dependent on wild resources must be flexible to take advantage of such dynamics.

An extensive knowledge of the natural environment and the behavior of the living environment is required to most effectively take such advantage, an attribute gained from early training and diligent application. The best hunters possess the highest degree of knowledge, experience, and ability and are most successful in appropriating subsistence resources. Such hunters practice respect for the environment, gain community respect through appropriating resources beyond family needs to share with others, and provide a positive role model for the young also seeking such respect in life. In traditional times it was the maternal uncle who took responsibility for training nephews in the methods and techniques of hunting and fishing. This is not always the case in contemporary times, but the responsibility continues to be contained within the family, although not necessarily carried out by the maternal uncle. Boys are taught how to take care of rifles and hunt, generally around 10 or 11 years of age, and are usually able to go out without direct supervision after that. Now that most children are remaining on the islands for their education, the skills are more easily transferred.

b. Cultural Constructs: A sense of reciprocity overlays all subsistence activities. This sense of reciprocity is evident as well in Aleut cultural constructs, the belief systems, or the logic under which a culture operates (Kish Tu Addendum No. 2, 1981). The traditional Aleut cultural systems were sophisticated and varied, and included a rich material culture (see Jones, 1976; Lantis, 1970; and Graburn, 1973). Traditional cultural institutions included a class system and distinctions based on wealth. Wealth was not the sole criterion of status and prestige however. The wealthy were respected not only for their possessions, but also for their personal attributes, such as skill in hunting and bravery in warfare (Jones, 1976). Status was thus ascribed and achieved, the latter through demonstrating the values Aleuts valued most highly: generosity, fortitude, patience, industry; self-sufficiency, cooperation and skill, bravery, and daring in hunting and war (ibid.).

There was probably no overall Aleut sociopolitical organization higher than the village or island level, but intervillage mobility, marriage, trade, and warfare took place. Within the village, Aleuts placed highest emphasis on cohesion, harmony, cooperation, generosity, and avoidance of conflict at all costs (ibid.). Aleut norms discouraged quarreling, gossip, theft, and other behavior that might disrupt community harmony. The Aleut language, according to Jones (1976), did not contain a single derogatory term, and Aleuts became profoundly upset when given an undeserved reproach. The office of chief has been described as both ascribed or hereditary and achieved through the demonstration of skills as warrior, hunter, and organizer of collective activities (Kish Tu Addendum No. 2, 1981). Accurate information on this subject is not available (ibid.).

Aleut religious beliefs were inseparable from their total philosophy. Through their daily activities, the Aleuts sustained an essential contact with the natural and supernatural world (Jones, 1976). The Aleut shaman, through knowledge of proper behavior and special relationship with the spirits, was the interpreter of the supernatural world. The role as healer and curer of the sick was closely integrated with a religious role, since each human body had inherent supernatural power (Laughlin, 1951).

Russian influence on the Aleut cultural systems was not as catastrophic as on the welfare of the people themselves (Kish Tu Addendum No. 2, 1981; see Sec. III.C.1. on Population). The Russians introduced a barter system of exchange and a three-chief system of leadership. In addition to disturbing the economic and political equilibrium of the Aleuts, the Russians brought about changes in the religious, ceremonial, and family spheres as well. Despite these apparent changes, many aspects of the old culture survived in original or modified form (Jones, 1976). The sea was still the primary source of food, shelter, boats, and equipment. Socialization was left in the hands of the villagers and a traditional orientation to marriage was still evident (as discussed in the section on kinship and social organization). With the purchase of Alaska by the United States in 1867, the introduction of Western material culture and the cultural imperialism demonstrated by missionaries, teachers, and other settlers, brought about further disruptions of the Aleut's traditional way of life (ibid.).

The cultural values and orientation of contemporary Aleuts are a unique blending of traditional and modern attitudes. Perceptions of sacred and holy places are shared by young and old, with many considered special or possessing supernatural qualities (Kish Tu Addendum No. 2, 1981). These supernatural qualities may stem from some historical event, such as an accident or death, or because of some unknown spiritual affinity or quality the area is thought to possess. Spirits, both good and evil, can affect a person's health and well being, especially if one is from the more isolated and less traveled villages (ibid.).

The qualities and virtues admired and respected in traditional times are still those most valued. Individuals are taught and admonished to be generous and cooperative. Rather than attempt open confrontation or conflict, a more passive-aggressive mode may be employed, including avoidance, ridicule, or mockery. Such methods are also employed in child rearing. Children are rarely disciplined but are expected to model their behavior after adults and respond to cues from them (ibid.).

The themes of cohesiveness and cooperation are often used today in the context of Aleut regional organizations (ibid.). This is a modification of the traditional attributes of the group, which only extended to the village or island level. The concept of region, introduced by the Alaska Native Claims Settlement Act (ANCSA), is an emerging consciousness combined with local identity (ibid.). Issues of rank, status, and class in village and regional organizations are also unclear, although traditional and contemporary knowledge systems play a part in such matters. Education is highly valued as well as the knowledge, experience, and abilities of the best hunters. The traditional systems of rank and status associated with aspiring to and acquiring hunting skills is still operative in the Pribilof Islands' fur seal harvest (Smythe, 1981). The chief and elders' system is no longer apparent but may operate in a covert, more informal, and less structured manner in the affairs of such contemporary decisionmaking structures as regional and village corporations, city councils, IRA traditional councils, or school boards.

c. Kinship and Social Organization: Aleut social organization in traditional times was, by some standards, relatively simple, although there is very little documentation available (Kish Tu Addendum No. 2, 1981). In most respects, Aleut social organization seemed marked by fluid social patterns and habits, rather than strictly defined rules. In addition to the elements of social organization previously discussed, the respective roles of the nuclear family and larger community have changed in response to rapid and pervasive acculturation. The role of the traditional council in social control, for example, has changed dramatically, and vestiges of the traditional patterns is difficult to discern. The role of the community to exercise censure as a form of social control, however, is still strong. It is possible that acculturation, especially religious change, may have had an impact on the persistence and possibly the strengthening of this pattern (ibid.).

Patterns of social exchange and reciprocity so crucial to the traditional Aleut adaptation have changed somewhat from earlier times. In the past, well ordered rules and habits of sharing of both food, goods, and services underlay the Aleut social order. Today, such patterns continue to be significant in Aleut communities, although in modified forms, and sharing is still critical to the Aleut in terms of sheer livelihood and personal satisfaction with "the good life" (see Kish Tu Addendum No. 3, 1981 and Smythe, 1981). The presence of community-wide sharing patterns is most evident with the distribution of large mammals, such as sea lions. Cash is shared in the family, but this commodity is not subject to the wider sharing patterns that have a traditional underpinning (Kish Tu Addendum No. 2, 1981).

Jones (1980) and others have noted that the Aleuts in times past had a form of descent that was matrilineal. That is, one's "blood connection" was reckoned through the mother's line. With kinship determined through the mother's side, that means that "you" are in the same group as your mother. Your father, since one marries out of the group, is thus in a different group. Under this system, the role of the maternal uncle was important. He was the closest relative and elder male. He played an important part in many aspects of child rearing, discipline, and training as indicated earlier (see subsistence orientation).

Only fragments of this system exist today. A preferred pattern of exchange still seems to involve the maternal uncle. Inheritance, on the other hand, now follows the Western model through the male line. Adoption may still follow the traditional mode. The trend toward fragmentation of the extended family and the growth of the nuclear family as both a family of orientation and residence, is a trend common throughout Alaska. The lack of an income source forces males temporarily to abandon their villages and range far and wide in search of wages to support their households in the villages. Under these circumstances, the role of the mother has become increasingly important. Division of labor in day to day subsistence pursuits and family affairs has changed considerably from the traditional rules of role differentiation.

d. Influence of the Orthodox Church: The historic role and influence of the Orthodox Church (now referred to as the American Orthodox Church) in the Aleutian-Pribilof Islands region has been well documented (Smith, 1980; Jones, 1976; Lantis, 1970). The Orthodox Church was perhaps the most lasting legacy of the 126 years of Russian control of the area. The religion of the Russians was Eastern Orthodoxy, which displayed a perspective on the world different from Western religions. According to the advice of one seminarian:

"Our Orthodox perspective is eastern and different from western religions. It is more integrated--the Church is the people" (Kish Tu Addendum No. 2, 1981). Reasons given for the ready adoption of the Orthodox religion by the Aleut people vary (Jones, 1976; Smith, 1980), but the effect has been the shaping of the Church and community interactively over time and the creation of an institution that is a most pervasive influence in the lives of Aleut people.

In Orthodox communities, the Church acts as the keeper of the community value system. The force of the Church is present throughout the year but is most prominant during major religious holidays, such as Russian Christmas and Lent. The institution of name days is an example of celebrating events of the Church calendar throughout the year. During Lent, the importance of subsistence salmon and halibut fishing becomes most evident because consuming animal flesh is prohibited.

Values engendered by the Church include a sense of respect and a positive appreciation of literacy. Respect is a value taught and enforced by the Church (Smythe, 1981). The learning of this value is illustrated by the institution of godparents, which an individual receives when baptized and toward whom proper behavior is expected. Respect is an important attribute of such behavior and is a significant cultural orientation (ibid.). A high appreciation for literacy is additionally significant to cultural orientation, a value which is an integral part of the mode of behavior the Church seeks to engender (ibid.). These and other cultural values and orientations encouraged by the Church contribute to the means by which individuals organize their perceptions and understanding of respective roles in the Orthodox community.

e. Intra-regional Differences: Although the character of the Aleutian-Pribilof Islands region is distinctly made in the tradition of the Aleut, differences stand out in some communities as a result of differences in history or experience with other sociocultural systems. Cold Bay was founded as a military airfield during World War II and remains oriented to air transportation, although the military presence today assumes a minor role in the community. Scandinavians settled on the Alaska Peninsula and Shumagin Islands in the early days of the cod fisheries, intermarried with the Aleut, and were instrumental in diffusing knowledge and traditions of commercial fishing as an adaptation of the Aleut maritime tradition (Jones, 1973). Adaptations of Scandinavian languages are still spoken in parts of the region. The influx of military personnel to the Unalaska/Dutch Harbor area during World War II encouraged the establishment of Unalaska as a first class city in 1942 (Jones, 1969), as a means of mediating the potentially dominant influence of such presence. The effects of the withdrawal of the military after the war persisted through the 1960's, reversed by this time to the beginnings of another boom cycle of growth induced by an externally-based corporate presence.

Formal structures of civil and tribal (IRA Councils) governance have been formed elsewhere in the region, but Cold Bay residents have resisted formal civil structures in favor of more informal means of community problem solving. The ability of company and government organizations to provide selected public services and the limited loyalty to place of the population generally have been factors combined in Cold Bay to bring about an individualistic, frontier concept of community conditioned by organizational prerogatives. Although perhaps less distinct in Cold Bay, variations in dependency relationships as a factor conditioning sociocultural systems have persisted for more than a century on the Pribilof Islands. The servitude to the fur seal harvest imposed on the Pribilof Aleuts by the Russians and perpetuated by "Fisheries" (the National Marine Fisheries Service) (see Jones, 1980) is a classic case of dominant/dependent relationships, from which a lingering dependence on "Fisheries" can be expected to be ingrained to the sociocultural systems of the Pribilofs. Mediation of the relationship has been actively pursued by leadership groups on the Pribilof Islands.

f. Future of the Environment Without the Proposal: The rapid expansion of the bottomfishing industry is expected to be the driving force for growth in the region through the forecast period (through the year 2000). The effects of fisheries-induced growth on sociocultural systems are not expected to be uniform in the region but are projected to be localized at St. Paul, Unalaska, Cold Bay, King Cove, and Sand Point. The effects of such growth on the sociocultural systems of the Aleut villages of King Cove and Sand Point are expected to be minimal and positive, since growth of this type is expected to contribute to higher diversification of existing maritime functions, projected at a rate capable of being gradually absorbed by the communities (see Sec. III.C.1.c.). The effects of growth on population and subsistence in the other communities, discussed in Sections III.C.1.c. and III.C.2.c., are the basis for this discussion.

St. Paul: The Aleut community of St. Paul is expected to have a bottomfishing processing plant and fishing venture operational by 1990. The decisionmaking processes and negotiations necessary to accommodate such a venture could produce stress among local leadership, especially if there were competing factions on how to improve economic conditions on the island. Additional pressures on leadership and an increased likelihood of maladaptive behavior by individuals and within families perceiving threat from such actions could be expected if these front-end decision processes took place in the context of a continued threat to curtail the fur seal harvest and/or divest management of the harvest from National Marine Fisheries Service. Realization of either of these potential threats could increase the stress experienced on the island and test the institutions of the church and the community as a whole (as one) to maintain traditional roles, values, and orientations. Although an enclave form of physical development is projected for the fisheries project, assumed to consist of group housing for individuals possibly rotated to and from the island, the absorption of heretofore underemployed resident Aleuts into the fishing and processing venture would likely produce social interaction with the new population and could lead to changes in the outlook, orientation, and possible control of the community over time. The experience that Unalaska Aleuts have undergone in becoming a minority on their own island in the not so distant past is perceived on the Pribilofs as an unwanted effect from development (personal communication, Smythe).

Unalaska: Unalaska, anticipated to be the focal point for intensive effects from bottomfishing industry development, is projected to grow from a population of about 1,300 in 1980 to about 13,000 in the year 2000. The Aleut population of Unalaska as a group is anticipated to play a major role in the projected growth as land owner, through the Ounalashka (village) Corporation. Impacts to this segment of the total population, already stressed from growth in the recent past, could be intensified for those unable or unwilling to participate in the economic opportunities of growth. Increased costs, reduced access to subsistence resources, and increased social discontinuity from the boom town economy could further displace such people from throughout the community, regardless of racial origin, and place greater burdens on family members, church, and other social institutions. This segment of the Aleut population could experience added feelings of deprivation if corporate royalties from land leases were perceived as comparable to government transfer payments. On the other hand, for those willing and able to grasp economic opportunities, such as through the institution of the village corporation, the boom conditions could provide heightened revenues for successful accomplishment unavailable locally in the past.

For the greater population of Unalaska, the institutions of public decisionmaking and civil governance can be expected to be taxed to new levels of endurance in determining and accommodating policies of growth management and in mediating the social effects of a boom town. Existing sociocultural systems in terms of leadership patterns, perceived vestments of authority, traditional methods of social control, and the like could be further stressed if competing philosophies of growth were submitted as alternatives to open accommodation. New leadership and orientations to community life could result in the long-term from the boom, as newcomers, numerically in the majority, divest the community of former leadership figures and their points of view. In a broad sense, however, the orientation of the community is expected to remain with the sea.

Cold Bay: The projected growth of Cold Bay is numerically and proportionately smaller than for Unalaska, but the effects could be as demanding on the sociocultural systems of the community in the absence of institutionalized forms of public decisionmaking and growth management. The strength of accommodation of the existing informal social and political networks and coalitions could be subject to impact by the growth, but the potential consequences are speculative. A point may be reached where formal structures are deemed necessary by the majority of the population, in which case the individualism so prized in the community may subordinate to the collective good, but the prospects for the latter taking place are long-term, if at all. Leadership patterns and orientations from the former, however, have prospect for change, as in the case of Unalaska.

5. Community Infrastructure: Infrastructure is the basic, underlying framework or support system for a city, village, town, or borough. Community infrastructure includes: local government, housing, education, electrical power, water and sewer services, solid waste disposal, health services, police and fire protection, communication, and local transportation. Major transportation issues for the region and their associated impacts are considered in sections III.F. and IV.B.5 through G.5. of this document. Major villages and cities in the proposed lease area include: Nelson Lagoon, Cold Bay, False Pass, Akutan, Unalaska, Dutch Harbor, Nikolski, King Cove, Belkofski, Sand Point, St. George, and St. Paul. The villages of Akutan, Belkofski, False Pass, Nelson Lagoon, Nikolski, and St. George are discussed in section III.C.5.f. ('Other Villages').

a. St. Paul: St. Paul is located at the southern tip of St. Paul Island, the northern island in the Pribilof Island group.

Local Government: St. Paul is a second-class city incorporated in 1971. A seven-member city council (one member is the elected mayor) and a city manager oversee the operation of the city. St. Paul levies a three-percent sales tax. The city is responsible for road maintenance, police and fire protection, maintenance of the community repair shop, and implementation of community improvements. In addition, one person serves on the three-member Pribilof Island Management board.

Housing: There are 113 woodframe houses within St. Paul including the 20 units built by the Aleutian Housing Authority in 1978. The Aleutian Pribilof Regional Housing Authority has a waiting list, indicating that a housing shortage still exists.

Education: St. Paul is part of the Pribilof Islands Regional Education Attendance Area. The school houses grades kindergarten through 10, 12 teachers, and one superintendent. Students must go to boarding schools in Bethel or Anchorage to complete high school.

Electrical Power: The National Marine Fisheries Service owns five 150-kilowatt diesel generators for industrial, commercial, and residential purposes. All five generators are needed at peak times, although under normal loads only two generators are needed. Distribution is via underground lines for the entire community. Heat is provided by a combination of oil furnaces and electrical units.

Water Supply: The city maintains a water supply, storage, and distribution system, with water pumped from two wells to three 200,000-gallon tanks. Although chlorination and fluoridation equipment is installed, the water is currently untreated. Water is piped to all homes and buildings and the distribution system has additional capacity.

Sewage System: St. Paul does have a complete sewage system, served by clay, transite, and concrete pipes. Primary treatment of sewage is through a combined septic tank and leach field. The sludge is periodically pumped out and buried in the sanitary landfill near the airport. Seal processing wastes are first screened before they are dumped into the ocean.

Solid Waste Disposal: Solid waste disposal is a city-maintained function. It is picked up regularly and then dumped approximately 5 to 6 kilometers (3-4 mi) out of town near the airport.

Health Services: St. Paul is served by a small hospital-clinic located in a two-story woodframe building owned by the Public Health Service. It is staffed by a physician, nurse, three aides, and a secretary/receptionist/bookkeeper. The Coast Guard has a small infirmary, but usually the Coast Guard people go to the Native clinic for medical assistance.

Social Services: St. Paul has one patrolman to provide law enforcement protection and, if necessary, he can call on the State Troopers at Sand Point or Naknek. There is also a local magistrate to help settle legal problems. St. Paul has an all-volunteer fire department which has an average of 17 volunteers. They have two vehicles and, though adequate, the station itself is located in an old building. All buildings are within a reasonable distance of the hydrants. There are two sirens, adequate during all but very high winds and freezing have conditions. There is a sporadic attempt at training, and the community does have a fire prevention education program.

Communication: There is one community phone located in the community building served by the RCA Alascom satellite communication system. In addition, the village has citizen band radios that provide communications within the village and to St. George. Federal agencies, such as the National Marine Fisheries Service, Coast Guard, and the Weather Service, operate high-powered radios to the Aleutian Chain and the mainland.

Local Transportation: Access to St. Paul is via sea or air, under Visual Flight Rules (VFR). There is a scheduled commercial flight from Anchorage via Cold Bay sponsored by Reeves Aleutian Airways. The airstrip is 1547 meters (5,075 ft) of gravel. There are unpaved dirt roads connecting varying parts of the community.

b. Unalaska/Dutch Harbor: Unalaska is located on the northern and eastern edge of Unalaska Island and extends into Dutch Harbor. Dutch Harbor is located at the southern end of Unalaska, on Amaknak Island.

Local Government: Unalaska is a first-class city incorporated in 1942. Government is by a nine-member city council with a mayor elected at large. Unalaska has hired a full-time city manager to manage city affairs. Unalaska has a tax structure that includes a property tax and a sales tax. The for-profit Native corporation is the Ounalashka Corporation and the non-profit corporation is the Unalaska Aleut Development Corporation. Dutch Harbor is included in most of the Unalaska city limits and, therefore, does not have a city government of its own.

Housing: As of 1977, Unalaska had a total of 153 dwelling units not directly associated with the fish processing industry and approximately 1,188 dwelling units associated with the seafood processing industry. Table III.C.5.b.-1 shows the specific breakdowns.

Education: Unalaska has a modern school building with facilities for teaching students in grades kindergarten through twelfth grade. Unalaska is part of

Table III.C.5.b.-1
Unalaska Dwelling Units
June 1977

Type	Number of Units Existing	Number of Units Under Construction	Total
General Housing			
Multifamily Unit (1)	22	0	22
Mobile-Modular Units	14	0	14
Duplex Housing Units	20	12	32
Single Family Housing	97	1	98
Total	153	13	166
Seafood Processing Housing			
Onship Housing	872	0	872
Onshore Dormitory Housing	256	127	383
Multifamily Housing	10	10	20
Mobile Modular Housing	31	0	31
Duplex	6	0	6
Single Family Dwelling	13	0	13
Total	1,188	137	1,325

Source: Tryck, Nyman and Hayes. November 1979.

the Aleutian Region School System and its secondary program is used by other villages which do not have a secondary education program. The school facilities at Unalaska serve the children at Dutch Harbor.

Electrical Power: The existing electrical system serves only Unalaska and supplies power to approximately one-third of the community residents. There are three generators: two diesel generators at 200 kilowatts each and one at 600 kilowatts. A backup generator of 124 kilowatts is available. Distribution is via World War II vintage power lines which are in need of improvement or replacement.

Water Supply: Water is available from upper Unalaska Creek (dam site), Pyramid Creek (dam site) and, during low flow periods, supplementary water is drawn from two wells at the base of Unalaska Creek. Distribution is via World War II vintage wood stave piping which leaks significantly and is slowly being replaced by iron pipes. Fish processors in the harbor tend to draw water from the harbor for processing work. Potable water is usually obtained from onshore water sources.

Sewage System: Unalaska has no city-wide sewage system. Most residences use septic tanks, although a few are served by an antiquated military collection system which empties untreated sewage into Iliuliuk Bay. Fish processing wastes receive preliminary treatment at plant sites and are ultimately dumped into Iliuliuk Bay or Unalaska Bay through eight outfalls.

Solid Waste Disposal: There is one landfill on Amaknak Island and one north of Unalaska which are unsupervised with minimal compacting overcovering. A sanitary landfill is planned for Unalaska. It will be operated by the city and will serve both Dutch Harbor and Unalaska.

Health Services: Health care is provided by the Iliuliuk Family Health Service community clinic and by its associated clinic in Dutch Harbor. The clinic has x-ray and laboratory facilities and two overnight patient beds. There are two visiting physicians and one visiting dentist, whose visits average twice yearly. In addition, the regular staff consists of two physician's assistants, one registered nurse, one director, and one janitor. A physician is occaisionally brought in to the seafood processing plants during peak work seasons.

Social Services: Unalaska has both a fire chief and a police chief employed full-time. The fire department has 18 personnel and four "quick response" vehicles split between Unalaska and Dutch Harbor. The police department is staffed by four individuals, including the chief, and is also split between Unalaska and Dutch Harbor. There are three vehicles plus a police motor launch. There is also a detention facility, which has a capacity of two prisoners. Fire protection is also shared with Unalaska, although there are seven fire protection personnel located in Dutch Harbor. Two fire vehicles are located at Dutch Harbor and the community is partially hydranted.

Communications: Telephone service is operated by the Interior Telephone Company to serve approximately 200 homes and offices with a capability of doubling that service. Long distance service is available through an RCA microwave repeater station installed in 1977.

Local Transportation: Unalaska's roads are dirt and gravel and are graded by the city. Completion of the bridge between Unalaska and Dutch Harbor allows for vehicle traffic to commute between the two communities. The airport is served by Reeve Aleutian Airways, Inc., and is actually located at Dutch Harbor. Local charters include Peninsula Airways, Gifford Aviation, Kodiak Airways, and Air-Pac, Inc.

c. Cold Bay: Cold Bay is located at the extreme end of the Alaska Peninsula, adjacent to the bay of Cold Bay on the south side of the peninsula.

Local Government: Cold Bay is an unincorporated village located in an unorganized borough. There is little in the village that functions like the village councils and governments found in other Aleutian villages, as Cold Bay is not really a town or a village but, rather, a small grouping of government and private agencies. Cold Bay is the hub of the transportation and communications systems for the Aleutian and Pribilof Islands areas.

Housing: A 1970 census showed 75 housing units in Cold Bay: 22 single-family houses, 53 duplexes, and 2 mobile homes.

Health Services: Cold Bay has the Public Health Service (PHS) nurse for the Aleutian Island region. She is available to treat medical problems in Cold Bay when she is not visiting other villages.

Social Services: There is no law enforcement officer in Cold Bay, although there is a one-cell holding facility at the fire station. State Troopers are available at Sand Point, Naknek, or the detachment headquarters at Kodiak. Fire protection in Cold Bay is quite good. Protection is provided by the State of Alaska, Division of Aviation. Three fire trucks, including a tracked-vehicle to reach difficult locations are available. Both water and foam are available to fight a fire. All homes are reported to have at least one fire extinguisher and some have smoke detectors. The warning system consists of three sirens.

Communications: There is one community phone and numerous business phones, all available through the RCA Alascom satellite communications system.

Local Transportation: Cold Bay functions as the main transportation hub for the Aleutian/Pribilof Islands region. The Cold Bay airport has two asphalt runways, one with a length of 34,161 meters (10,415 ft) and the other with a length of 16,813 meters (5,126 ft). The airport is served by mainline commercial flight service from Anchorage via Reeve Aleutian Airways, Inc. In addition, there are several smaller airlines which provide charter service to other communities in the region.

d. King Cove: King Cove is located on the south side of the Alaska Peninsula, approximately 29 kilometers (18 mi) southeast of Cold Bay.

Local Government: King Cove was incorporated in 1974 as a first-class city. The community is governed by a mayor and a seven-member city council, elected each April. The city levies a one percent sales tax, including raw fish products, and a property tax.

Housing: There are approximately 71 housing units unrelated to the cannery operation. Of the 71 units, 57 are single-family homes, one is a duplex, four are structures with a total of nine apartments, three are residential-commercial units, and one is a clinic-residence. The cannery has two large bunkhouses and 12 other housing structures. In addition, there are several mobile homes and two or three fishing boats used as residences.

Education: The school in King Cove is an independent district, no longer associated with the Aleutian Region School District. The building contains nine rooms, a library, conference room, three offices, and a gymnasium. There are 14 teachers for students in grades kindergarten through twelve.

Electrical Power: King Cove has a city-owned electrical system powered by three diesel generators used singly or in combination with distribution to all but four outlying structures. Forty-three users are charged ten cents per kilowatt hour and twenty-one are charged a flat rate of thirty dollars per month. The system is reported to not function effectively, to have frequent outages, and to have a poor distribution system. An underground distribution system is being considered as a replacement.

Water Supply: Reportedly, the village has a good water supply system, originally developed for the cannery. Water is obtained from a reservoir at lower Ram Creek. Water is carried through buried pipe to a treatment building and then distributed to the cannery and all dwellings in the village. The rate in 1979 was $12 per month per household. Dwellings on the west side of the village across the lagoon have their own water supply trapped from surface drainage.

Sewage System: King Cove's sewage disposal system, built in 1970, has, reportedly, never functioned effectively. When the system functions, it dumps treated wastes into the cove; when not functioning, untreated sewage is dumped into the cove or the lagoon. Residents are not encouraged to hook into the system until it is repaired; however, repair of the system has been delayed due to delays in grant money. The cannery dumps sewage into the cove through an ocean outfall.

Solid Waste Disposal: Solid waste disposal is a municipal function. Garbage is collected three times weekly from nine pickup sites located around the village and then dumped at a landfill disposal site or burned in back of the town.

Health Services: The city of King Cove and the cannery have hired a licensed practical nurse to operate a small clinic in a cannery-owned house. Regular clinic hours are maintained; however, the nurse is available for emergencies 24 hours a day. Care is considered to be inadequate to meet the needs of the village. There is no direct line to the Alaska Native Medical Center. Itinerant teams of medical personnel visit King Cove approximately twice a year. Visits are generally considered to be inadequate in terms of frequency and length of stay.

Social Services: There is one individual who acts as a police chief/fire chief/harbor master. There is a volunteer fire department. Law enforcement is available from State Troopers stationed in Sand Point or Naknek.

Communications: King Cove is served by the Interior Telephone Company which is tied into the RCA Alascom satellite communications system. In addition, the city receives direct commercial and educational television progamming. The village communicates by citizen band radio, while the cannery and some boats have standard broadcast and shortwave radio systems.

Local Transportation: King Cove is accessible by air and water. The village has a 1311 meter (4,300 ft) gravel runway approximately 7.7 kilometers (4.8 mi) from town. There is twice weekly amphibious air service from Cold Bay and charter is available from Cold Bay and Sand Point. There is no marine passenger service. The few gravelled and unimproved roads are well-traveled by the 30 to 40 cars, trucks, and three-wheeled motorcycles in the village.

e. Sand Point: Sand Point is located on Popof Island, in the Shumagin Islands group on the southern side of the Alaska Peninsula.

Local Government: Sand Point is a first-class city incorporated in 1978. Local government is by a mayor-city council form, all of whom are elected and who serve staggered terms. A city manager is employed part-time (shared with King Cove) to provide day-to-day administration.

Housing: There are approximately 125 homes in Sand Point and intent is high toward building more. Little information is available on the quality or condition of the homes.

Education: Sand Point, since incorporation as a first-class city, has had to provide its own educational system. The school serves students from kindergarten through the twelfth grade.

Electrical Power: Electricity is provided to all homes and buildings through four diesel generators (two each of 500 kw and 300 kw units), of which usually only two are used at a time. Waste heat from the generating system is used to heat five large buildings located near the power house.

Water Supply: Water is supplied from a small reservoir located on Humboldt Creek. After fluoridation and chlorination the water is piped to all locations except the airport. Households pay approximately $12.50 per month for water service.

Sewage System: Sewage for all of Sand Point, except the airport, is collected by the municipality, processed by aeration, and the sludge is then dumped into the sea. Service costs approximately nine dollars per month.

Solid Waste Disposal: There is no city-wide, city-monitored or controlled form of solid waste disposal in Sand Point. Instead, each family, individual, or household is responsible for its own solid waste disposal. A sanitary landfill area is available a short distance away from the community.

Health Service: Health care is provided by the city in a clinic transferred to it in 1978 from the Baptist General Conference. The clinic is staffed by a Registered Nurse who holds regular clinic hours and who charges around five dollars per visit.

Social Services: Fire protection is available in Sand Point, although the interest in maintaining an active force goes up and down. There is a fire chief, two vehicles, and some interest in obtaining a tracking vehicle to reach homes beyond where the road ends. There is also a fire siren and most homes have fire extinguishers, although many no longer work. There is no local law enforcement within Sand Point. The State Troopers stationed there handle the law enforcement problems.

Communications: Reportedly, a private company provides telephone service to all homes. Telephone service is judged to be generally poor, and long distance calls are, apparently, difficult to make.

Local Transportation: Sand Point is served by a scheduled airline from Cold Bay and also by charter. The airport is approximately 5 kilometers (3 mi) from the city and is a 1159 meter (3,800 ft) long gravel runway. There is a small boat harbor and an excellent marine harbor area. The city is served by some roads in and around the local area.

f. Other Villages: The remaining villages in the Aleutian/Pribilof Islands area do not require a detailed community infrastructure analysis, however a brief review of the infrastructure components is useful. These villages are: St. George, located on St. George Island in the Pribilof Island group; Nikolski, located on the southwest end of Umnak Island; Akutan, located about 27 kilometers (17 mi) east of Unalaska and 32 kilometers (20 mi) west of Unimak Pass on Akutan Island; False Pass, located on the northern and eastern side of Unimak Island; Nelson Lagoon, located approximately three-quarters of the way down the north side of the Alaska Peninsula; and Belkofski, located on the southern end of the Alaska Peninsula, approximately 19 kilometers (12 mi) southeast of King Cove.

Table III.C.5.f.-1 lists the six villages, with their major infrastructure components. Symbols in the table indicate the following:

x-the village has that infrastructure item
v.c.(4)-there is a village council form of government, with four board members
762 m (gvl)-the airstrip or airport is about 762 meters (2500 ft) in length, with a gravel surface
k-8 - the school has grades kindergarten through eighth grade
v.d.-the fire department is a volunteer department
S.T.-State Troopers are available at Sand Point or Naknek; there is no police officer for the village.

g. Future environment without the proposal: The potential expansion of the bottomfish industry in the Aleutian/Pribilof Islands region is likely to create the biggest impact on community infrastructure in the region in the future if there is no OCS development. A study by Earl Combs Inc., estimated that the bottomfish industry in the Aleutian Islands region will be totally controlled by domestic fisherman and processors by the end of the century. Forecasts of future local employment, though speculative to a degree, predict tremendous increases of resident employment and increases in transient labor force for the Aleutian Islands. Since infrastructure impacts are directly tied to population levels, extreme growth management problems

Table III.C.5.f.-1
Community Infrastructure

Infrastructure	Community Akutan	Belkofski	False Pass	Nelson Lagoon	Nikolski	Saint George
Form of Government	v.c. (4)	v.c. (6)	v.c.	v.c. (5)	v.c. (5)	v.c. (7)
Airport/strip			762m gvl (2500 ft)	1006m gvl (3300 ft)	1159m gvl (3800 ft)	701m gvl (2300 ft)
Amphibious Aircraft Landing Area	X	X	X	X		
Roads					X	X
Boardwalk	X		X			
School	k-8		k-12	1-10	k-8	k-8
Community Health Aide/Nurse	X		X	X	X	
Hospitial/Clinic						X
Telephone	X		X	X	X	X
Radiophone	X		X			
SSB Radios	X		X	X	X	
Fire Protection	v.d.					v.d.
Police Protection	S.T.	S.T.	S.T.	S.T.	S.T.	S.T.
Central Electricity	X			X	X	X
Individual Generators		X	X		X	
Sewage System						X
Flush Toilets	X		X	X	X	X
Septic Tanks			X	X	X	X
Solid Waste Collection						X

Table III.C.5.f.-1
Community Infrastructure
(continued)

Infrastructure	Community Akutan	 Belkofski	 False Pass	 Nelson Lagoon	 Nikolski	 Saint George
Garbage burned individually	X	X	X	X	X	
Untreated Water	X	X	X	X	X	X
Treated Water					X	

Source: U.S. Dept. of the Interior, Bureau of Land Management, Alaska Outer Continental Shelf Office.

could be expected to expand and increase in conjunction with population increases. Direct impacts associated with bottomfishing are analyzed in Section IV.C.2.e.

D. Cultural Resources

The proposed sale 70 area, the surrounding continental shelf and onshore area, and possibly the south side of the Alaska Peninsula have been habitats of prehistoric and historic people for thousands of years. There are valuable known and undiscovered cultural resources in these areas. Graphic 4. shows generally where and to what extent the resources have been predicted, surveyed, and listed. A more detailed account of these resources can be found in OCS Technical Paper No. 2 (Tornfelt, 1981). In addition to describing the cultural resources of the Bering Sea area, this paper describes the policies and procedures of managing these resources and gives references for further specific information about the resources. Further information can also be found in Alaska Regional Profiles, Southwest Region (Selkregg et al., 1976) and in the Alaska Heritage Resources File (Alaska Department of Natural Resources, 1980). Although quadrangles listed in Technical Paper No. 2 (Tornfelt, 1981) include much information for the south side of the Alaska Peninsula and Aleutian Islands (Pacific Ocean side), additional information can be found in the Alaska Heritage Resources File (Alaska Department of Natural Resources, 1980).

The area around the Pribilof Islands has high probability of prior human habitation. As shown on Graphic 4., a small portion of the proposed sale area lies within this high probability area. Most of the proposed lease sale area lies within an area of low probability of human habitation. For details on underwater probabilities of human habitation see Dixon, Sharma, Stoker (1976). Further information on sea level stands in prehistoric times may be found in Hopkins (1973 and 1979).

The 17 lease blocks which have high probability for human habitation are 341, 342, 385 through 390, 431 through 434, 476 through 478, 521, and 522 (Graphic 4 and USDI, BLM, official protraction diagram Number NO2-8).

The following resources, in particular, are of high historical or cultural value:

1. Sitka Spruce Plantation. Located on Amaknak Island, Dutch Harbor, Unalaska Island, Alaska; latitude 53° 51' 18" N, longitude 166° 32' 31" W., this site is of historical significance. The planting of Sitka Spruce in 1805 on the naturally treeless Aleutian Island of Amaknak is the oldest recorded forestation project on the North American continent. The project reflects Russian interest in developing the Aleutian Islands in order to make them, as well as all of Russian America, more self-sufficient. The planting of the trees was reportedly ordered by Imperial Chamberlain Nikolai Petrovich Rezanov in 1805. A naturalist with the Otto Van Kotsibue Expedition (1815-1818) noted that most of the young trees had perished, and the remaining young trees were barely surviving. In 1834, Father Ivan Veniaminov noted the slow and uneven rates of growth among the 24 remaining trees. A second group of trees were planted in 1834 and information about the two groups of trees were mentioned in a report by Bernhard Fernhow of the Harriman Alaska Expedition in 1899. In

1975, there were six remaining trees. A unique record of men's efforts to alter the natural setting, the trees are dwarfed in size and gnarled in appearance to survive in the hostile environment.

2. Church of the Holy Ascension. Located in the village of Unalaska/Dutch Harbor, Unalaska Island, Alaska, this church is of historical significance. The central portion of the Church of the Holy Ascension dates from 1824 to 1826, making this structure the oldest Russian-constructed church standing in the United States. The Church of the Holy Ascension is also the finest and best-preserved example in Alaska of a 19th century Russian Orthodox Church constructed on the Pskov or cruciform ground plan. In 1824, the cornerstone for the Church was laid by Father Ivan Veniaminov, famous churchman, missionary, and later (1841), the first Bishop of Alaska. The church of the Holy Ascension is in good condition and is still used as an active church.

3. Fur Seal Rookeries. These rookeries, located on St. Paul and St. George Islands, are of cultural and historical significance. Since 1787 they have been the greatest single source of furs in the world. The Pribilof Island rookeries still exhibit, in living form, the fur resources that lured Russian, British, French, Spanish, and American fur hunters from the 18th century to the present. In June of each year the fur seals come to the rocky beaches of the Pribilof Islands. The animals mate and seal pups are born and taught to swim. Each November, the great herds depart on their annual southern migration, not to return until the following June. In July and August of each year, the Aleut inhabitants still hunt the fur seals using the methods and techniques that have been employed in the fur trade since 1787. The seals have been threatened with extinction on several occasions and the existing flourishing seal herds serve as an outstanding example of the international application of conservation principles, as embodied in the terms of the North Pacific Sealing Convention of July 7, 1911.

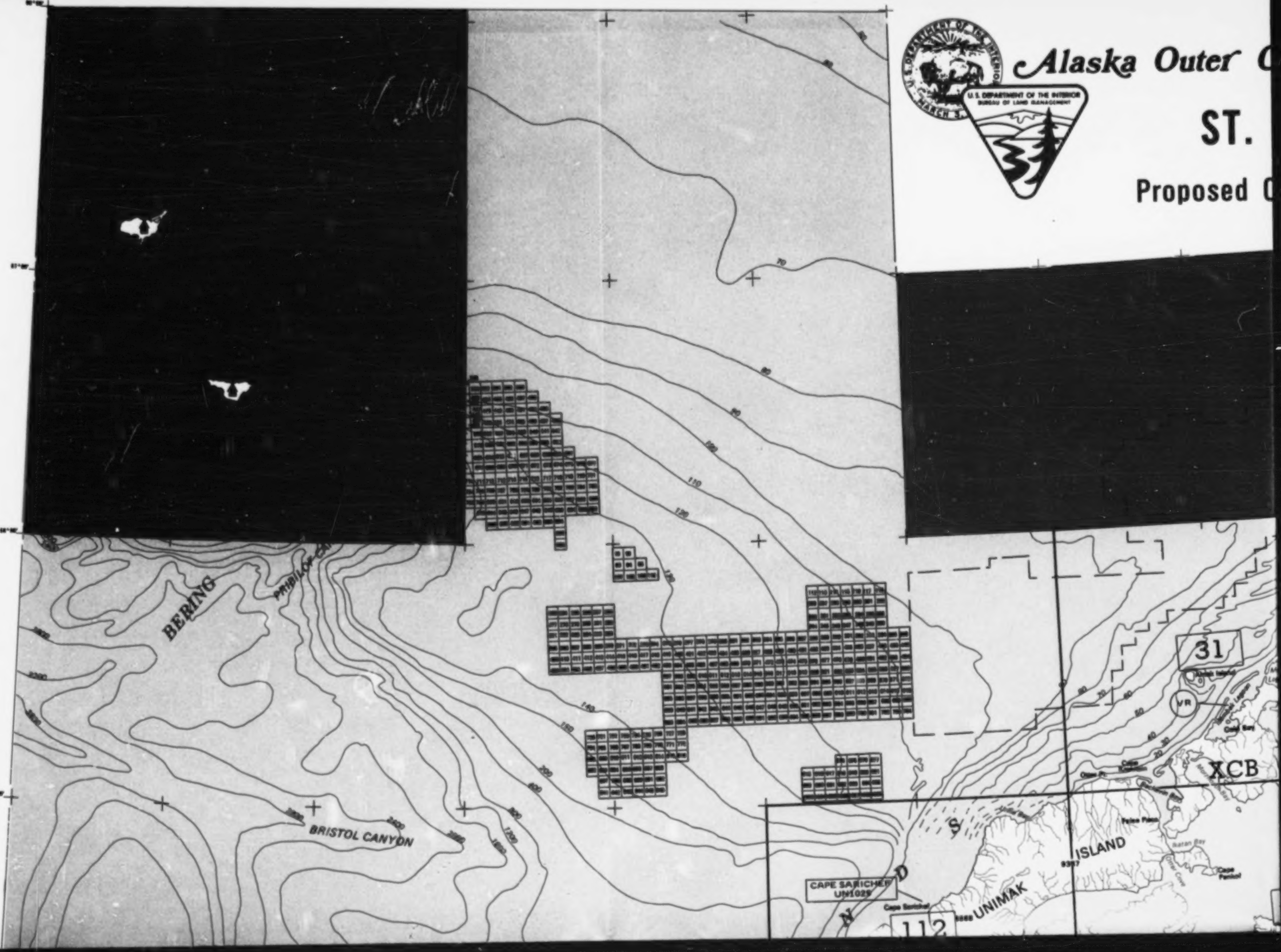
4. Remnants of World War II. Remnants of World War II are among the important historical resources of the Aleutian Islands, the Alaska Peninsula and the Pribilof Islands. Examples of these are the National Register sites such as the B240 Liberator Plane (ATK036), the ATTU Battlefield (ATU006), and the Temnac P-38 (ATU051) (Tornfelt, 1981).

5. Shipwrecks. Table III.D.5.-1 lists shipwrecks in the Unimak Pass area. See Tornfelt (1981) for a discussion of shipwrecks.

E. Economic Conditions

1. State and Regional Economies: The economic impact of proposed OCS petroleum development in the St. George Basin area is expected to be minor in areas of Alaska other than the Aleutian Islands Census Division in which the development would occur. For that reason, this DEIS does not discuss the statewide and regional economic impacts. A description of the economy of Alaska and historical economic and population statistics are provided in OCS Technical Report No. 57 (Univ. of Alaska, Institute of Social and Economic Research (ISER), 1981). That report also provides information about the economies of several regions of Alaska which could be affected in varying degrees by the proposed development, including the Southwest Alaska Region of which the Aleutian Islands Census Division is a part.

159


BERING
PRIBILOF CA
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ISLAND
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Alaska Outer C

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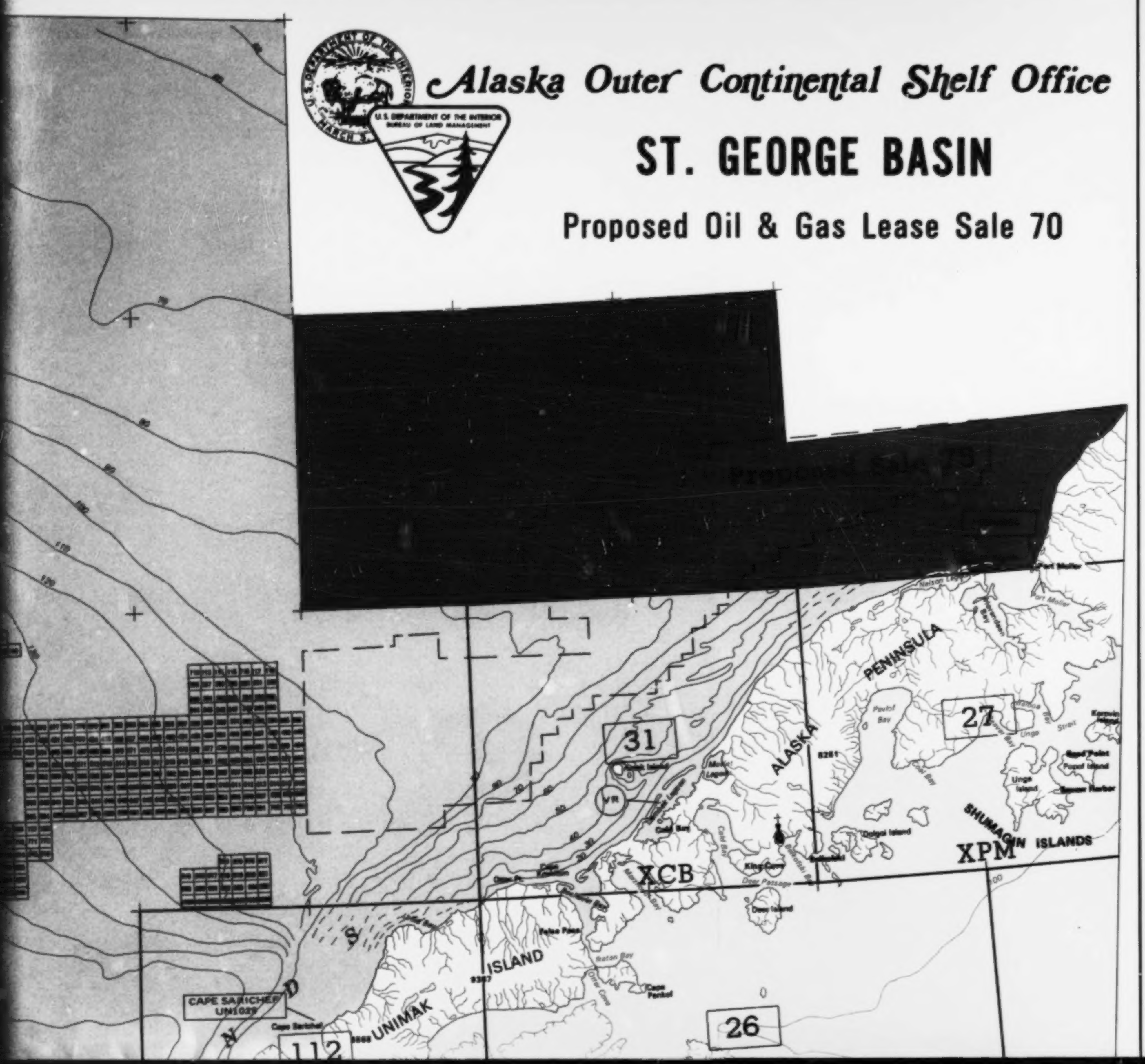
Proposed C

Alaska Outer Continental Shelf Office

ST. GEORGE BASIN

Proposed Oil & Gas Lease Sale 70


Port Moller
Nelson Lagoon
Port Moller
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ALASKA
Pavlof Bay
27
Korovin Island
Unga Strait
Sand Point
Popof Island
Unga Island
Squaw Harbor
SHUMAGIN ISLANDS
XPM
31
Amak Island
Moffet Lagoon
VR
Cold Bay
Cold Bay
8261
Dolgoi Island
King Cove
Belkofski Bay
Deer Passage
Deer Island
XCB
Morzhovoi Bay
Cape Krenitzin
Otter Pt.
Ikatan Bay
Otter Cove
Cape Pankof
False Pass
ISLAND
9387
UNIMAK
8888
Cape Sarichef
CAPE SARICHEF
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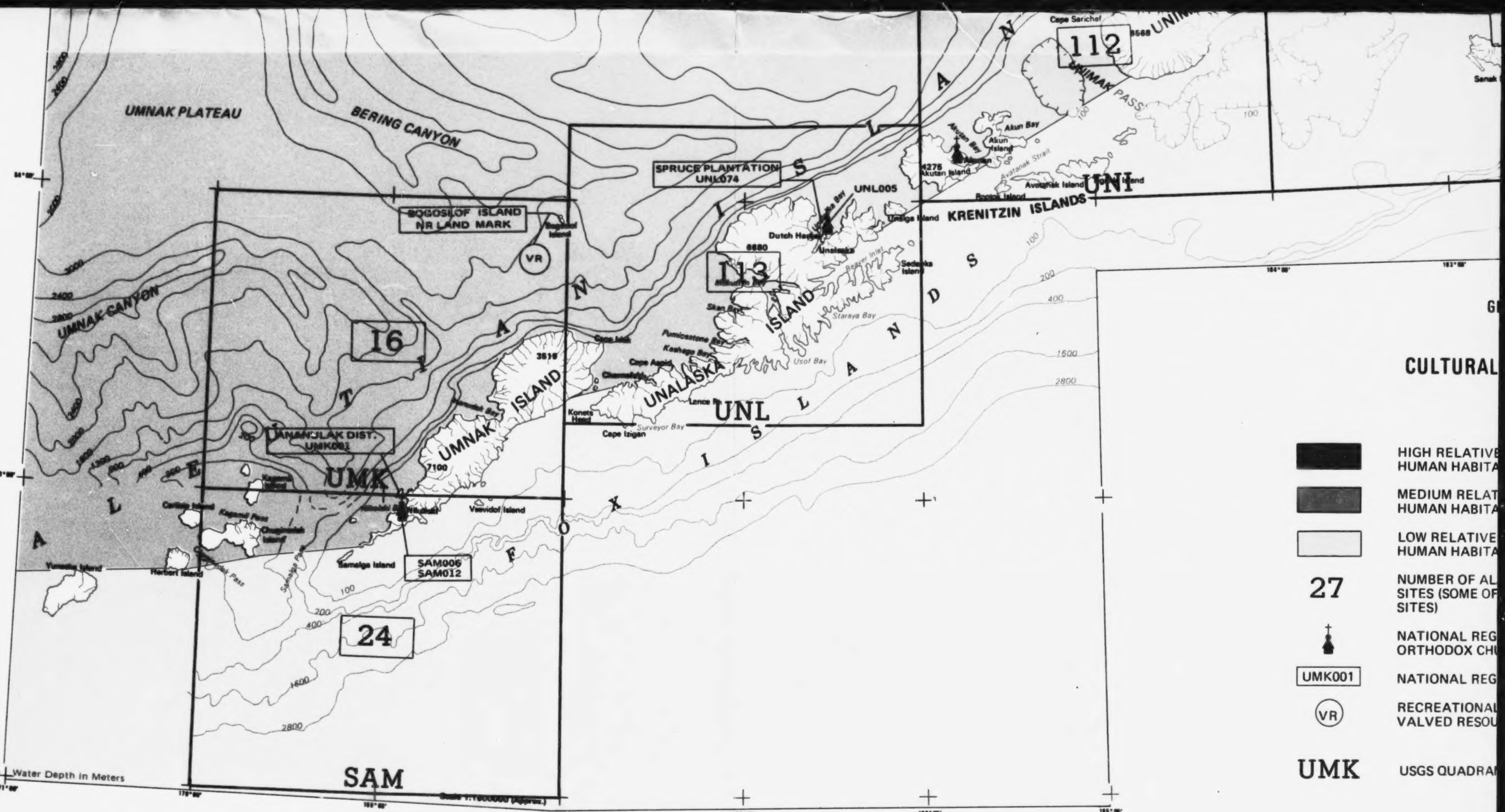
UMNAK PLATEAU
BERING CANYON
UMNAK CANYON
ALEUTIAN ISLANDS
FOX ISLANDS
KRENITZIN ISLANDS
UNIMAK PASS
BOGOSLOF ISLAND NR LAND MARK
Bogoslof Island
VR
SPRUCE PLANTATION UNL074
UNL005
ANANGULAK DIST. UMK001
SAM006 SAM012
16
112
113
24
UMK
UNL
UNI
SAM
UMNAK ISLAND
UNALASKA ISLAND
Dutch Harbor
Unalaska
Cape Sarichef
Akun Bay
Akun Island
Akutan Island
Akutan
Akutan Bay
Avatanak Strait
Avatanak Island
Rootok Island
Tigalda Island
Ugamak Island
Unalga Island
Sedanka Island
Beaver Inlet
Skan Bay
Staraya Bay
Pumicestone Bay
Kashega Bay
Usof Bay
Cape Aslik
Cape Idak
Chernofski
Konets Head
Lence Point
Surveyor Bay
Cape Izigan
Vsevidof Island
Nikolski
Samalga Island
Samalga Pass
Carlisle Island
Kagamil Pass
Chuginadak Island
Kagamil Island
Yunaska Island
Herbert Island
8588
4275
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CULTURAL
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MEDIUM RELAT HUMAN HABITA
LOW RELATIVE HUMAN HABITA
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NUMBER OF AL SITES (SOME OF SITES)
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RECREATIONAL VALVED RESOU
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USGS QUADRAN

SOURCE: Alaska Dept. of Natural Resources, 1981.
Dixon, E.J., et al. 1976.
Tornfelt, E. 1981.

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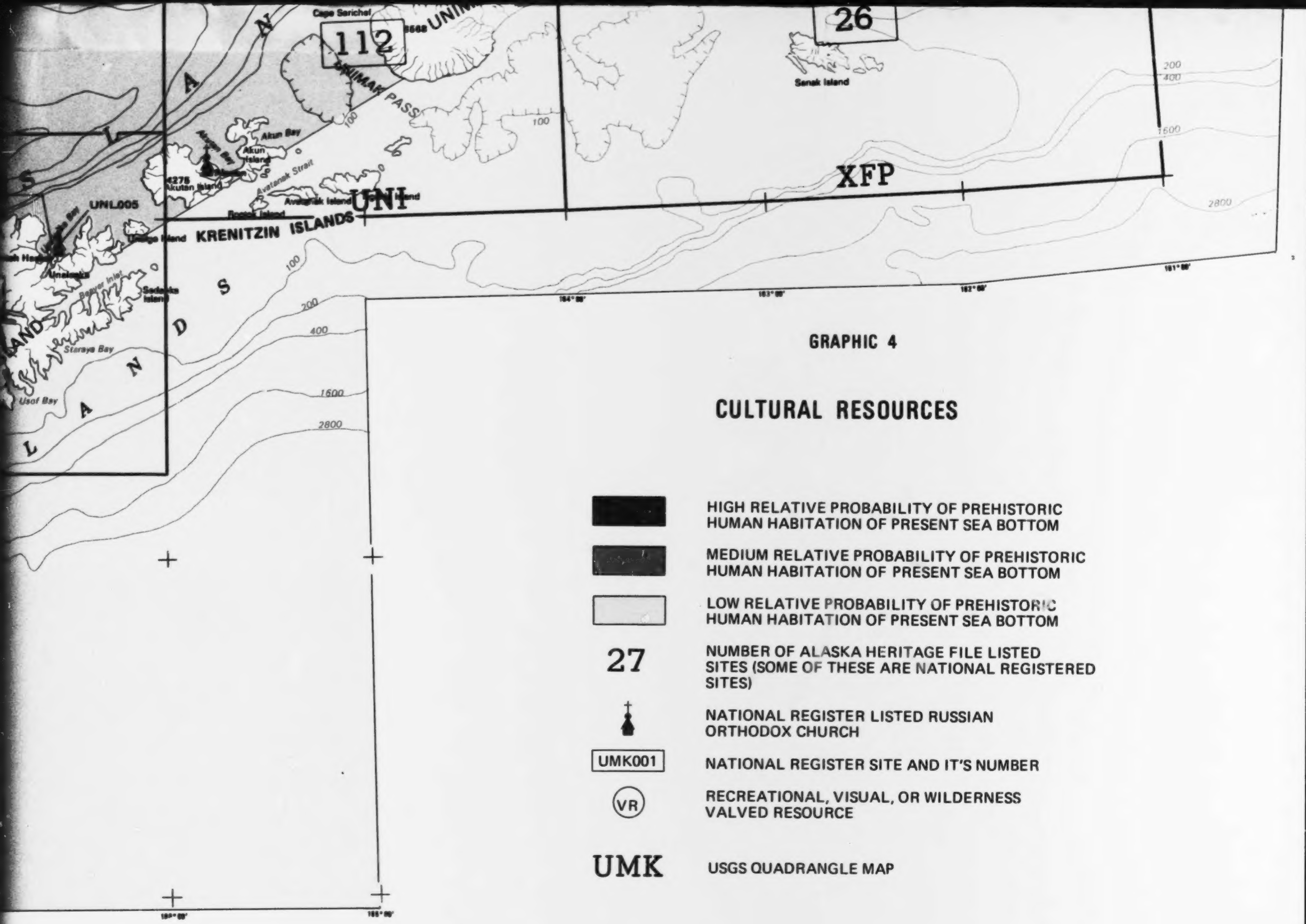
Cape Sarichef
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UNIMAK
UNIMAK PASS
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Senak Island
Akun Bay
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Akutan Island
Avatanak Strait
Avatanak Island
Rootok Island
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XFP
UNL005
KRENITZIN ISLANDS
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GRAPHIC 4

CULTURAL RESOURCES

■ HIGH RELATIVE PROBABILITY OF PREHISTORIC HUMAN HABITATION OF PRESENT SEA BOTTOM

▨ MEDIUM RELATIVE PROBABILITY OF PREHISTORIC HUMAN HABITATION OF PRESENT SEA BOTTOM

□ LOW RELATIVE PROBABILITY OF PREHISTORIC HUMAN HABITATION OF PRESENT SEA BOTTOM

27 NUMBER OF ALASKA HERITAGE FILE LISTED SITES (SOME OF THESE ARE NATIONAL REGISTERED SITES)

† NATIONAL REGISTER LISTED RUSSIAN ORTHODOX CHURCH

UMK001 NATIONAL REGISTER SITE AND IT'S NUMBER

(VR) RECREATIONAL, VISUAL, OR WILDERNESS VALVED RESOURCE

UMK USGS QUADRANGLE MAP

Table III.D.5.-1
Shipwrecks near Unimak Pass

Date of Shipwreck	Name of Vessel	Cargo Value in Dollars at Date of Shipwreck
1879	American Schooner "Bella"	---
1885	Bark "Montana"	50,000
1897	American Schooner "Therese"	3,000
1897	American Schooner "Hueneme"	32,500
1898	American Bark "Guardian"	12,000
1902	American Bark "J.B.Ward"	2,000
1907	Schooner "Glen"	20,000
1908	Schooner "John F. Miller"	20,000
1909	Ship "Columbia"	78,000
1914	Bark "Paramita"	200,000

Source: Marine Disasters of the Alaska Route by C. L. Andrews from Pacific Fisherman, Fisherman's No. November 1914 and Andrews list from U.S. Customs Office in Juneau and U.S. Customs Office in Seattle.

2. Local Economy (Defined as the Economy of the Aleutian Islands Census Division, with Emphasis on Selected Communities): The Aleutian Islands Census Division includes that part of the Alaska Peninsula west of approximately longitude 159° W., as well as the Aleutian Islands chain and the Pribilof Islands.

Within this census division, as in most of Alaska, military activities have constituted the largest single source of wage and salary employment from World War II to the present day. As recently as 1979, one-sixth of all wage earners in Alaska were active-duty military personnel or Federal government civilian employees in military-related jobs (Alaska Department of Commerce and Economic Development, 1980). In the Aleutian Islands Census Division, an even larger share of the cash economy is based on national defense. In 1979, approximately 52 percent of all wage and salary workers were fulltime uniformed military personnel or military-related Federal civilian employees (Table III.E.2.-1). However, in the Aleutian Islands Census Division, unlike many other parts of Alaska, the large military operation has almost no impact on the non-military sectors of the economy. This is due in part to the unusual nature of the Aleutian Island Census Division, which consists of a number of very isolated communities with almost no economic interactions. The vast majority of the military personnnel within the area are at Adak and Shemya Station, neither of which would be expected to be directly affected by proposed OCS petroleum development. Furthermore, neither Adak nor Shemya Station have significant economic relationships with any other area within the Aleutian Islands Census Division which could be affected by the proposed petroleum development. For these reasons, even though national defense is by far the largest source of employment, this aspect of the economy of the area is of little interest for the purpose of evaluating the impacts of proposed OCS development.

The second largest source of employment in the Aleutian Islands Census Division is the commercial fishing industry. The figures for manufacturing employment in Table III.E.2.-1 are virtually all seafood processing jobs. Manufacturing employment increased from 6 percent of all wage and salary jobs (including military personnel) in 1969 to 29 percent in 1979. Note, however, that Table III.E.2.-1 shows figures only for wage and salary employment, thereby excluding most fishermen, the great majority of whom are either fishing boat operators or crew members working for shares of the catch. An estimated 756 non-wage fishermen were employed in the Aleutian Island Census Division in 1978 on a twelve-month average basis (Univ. of Alaska, ISER, 1981). When these fishermen are included, total employment was 7,260 in 1978, with fishing and fish processing accounting for 33 percent of the total. No careful estimate of the number of fishermen in 1979 has been prepared. However, for a rough estimate it may be assumed that the number of fishermen increased from 1978 to 1979 in the same ratio as the increase in seafood processing employment, yielding a 1979 estimate of 811 fishermen on a twelve-month average basis. These 811 fishermen together with the 1,739 seafood processing jobs constitute 37 percent of the 1979 job total. Due in part to the remoteness and inclement weather of the Aleutians, as well as the seasonal nature of the fisheries, most of the fishermen and fish processors are not fulltime residents of the area. It is estimated that only 162, or 10 percent, of the 1,621 seafood processing jobs in 1978 were filled by permanent resi-

Table III.E.2.-1

AVERAGE MONTHLY WAGE AND SALARY EMPLOYMENT
ALEUTIAN ISLANDS CENSUS DIVISION, 1965 - 1979

Industry	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Construction	174	54	137	125	142	195	285	187	181	180	235	221	116	140	98
Manufacturing	292	411	422	471	349	476	657	610	675	851	783	991	1130	1621	1739
Transportation, Communications, and Utilities	83	55	51	46	57	45	61	41	93	93	87	88	38	31	55
Wholesale-Retail Trade	117	138	152	138	134	136	125	124	142	137	148	149	110^{e}	101^{e}	114^{e}
Finance, Insurance and Real Estate	4^{e}	4^{e}	4^{e}	1^{e}	5^{e}	7^{e}	7^{e}	8^{e}	7^{e}	12	27	32	37	38	40^{e}
Services	12^{e}	13^{e}	108^{e}	232^{e}	268	143	240	82	47	33	20	93	150	171	180
Federal Government, Total	678	707	633	550	523	528	574	640	704	813	626	618	569	682	704
(Military-Related)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(n.a.)	(486)	(397)^{e}
State, Local Government	128	138	157	160	174	168	178	206	227	257	316	330	287	371	387
Miscellaneous and Unclassified[1/]	6^{e}	6^{e}	50^{e}	112^{e}	75^{e}	23^{e}	51^{e}	84^{e}	110^{e}	97	107^{e}	99^{e}	37^{e}	0	0
Civilian Job Total	1494	1526	1714	1835	1727	1721	2178	1982	2186	2473	2349	2621	2474	3155	3317
Military Personnel	n.a.	n.a.	n.a.	n.a.	3927	3833	3994	3263	3314	3347	3410	3753	3462	3349	2735
Total[1/]	n.a.	n.a.	n.a.	n.a.	5654	5554	6172	5245	5500	5820	5759	6374	5936	6504	6052

e = estimated
n.a. = information not available

[1/] Includes sand and gravel operations related to construction.

Sources: Statistical Quarterly (Alaska Department of Labor). Numbers of military personnel were obtained from the U.S. Bureau of Economic Analysis.

dents of the area. The 1978 estimate of 756 fishermen is believed to have included about 251 permanent area residents, or 33 percent of the total (Univ. of Alaska, ISER, 1981).

The commercial fishing industry could be impacted by the proposed OCS petroleum development, and is therefore a major scoping issue in this DEIS. The following paragraphs describe the existing fishing industry of the area, including foreign as well as domestic fishing activities, and provide a brief description of future expectations for the fishing industry.

The most important domestic harvests from waters adjacent to the Aleutian Islands Census Division are salmon, halibut, king crab, tanner crab, and shrimp. Volumes and values of these catches are reported in Table III.E.2.-2. The table shows that total payments to fishermen for these fish and shellfish exceeded $200 million in both 1978 and 1979. However, not all of the catch reported in Table III.E.2.-2 was landed in the Aleutian Islands Census Division even though the catch was taken from waters adjacent to the census division. Most of the shrimp and much of the halibut was probably taken to Kodiak or elsewhere for landing. More than half of the salmon and the great majority of king and tanner crab probably were landed at points within the Aleutian Islands Census Division. The value of amounts landed within the census division in 1979 may have totaled $160 million.

The harvesting of fish by foreign fleets near the Aleutians has little or no economic impact on the Aleutian Islands Census Division, since the catch is not landed in the U.S. The foreign catch is significant mainly as an indication of additional amounts which U.S. fishermen may harvest in the future. Recent Federal legislation prohibits foreign harvesting of fish within 200 miles of U.S shores if American fishermen have demonstrated the ability and desire to perform the harvest. Presently, foreign fleets continue to harvest tanner crab and bottomfish from waters adjacent to the Aleutian Islands Census Division.

The foreign tanner crab fishery has been very active in the past. However, as U.S. capacity and interest have increased, the quotas allotted to foreigners have steadily declined. One may reasonably assume that, in the near future, the foreign tanner crab fishery will be completely displaced by the domestic fishery. Nonetheless, an allotment of 7,500 metric tons was awarded to Japan in 1980. The precise amount of the Japanese catch is not yet known, but assuming the Japanese harvested their quota, the dockside value of the catch, if landed in the Aleutians, would have been approximately $10 million. No other foreign nation harvested significant amounts of tanner crab in the Aleutians area in 1980 (Univ. of Alaska, Sea Grant Program, 1980).

The total foreign catch of all species of bottomfish in the waters adjacent to the Aleutian Islands Census Division has varied from about one million metric tons annually to over two million metric tons. The foreign catch in 1978 was about 1.3 million metric tons. The dockside value of this catch, if landed in the Aleutians, would have been roughly $500 million dollars (ibid.).

The foreign groundfish fleets also harvest large quantities of nontargeted species, including halibut, herring, crab, and salmon.

Table III.E.2.-2

VOLUMES AND VALUES OF CATCH FOR SELECTED FISH AND SHELLFISH
ALEUTIAN ISLANDS CENSUS DIVISION[1/]
DOMESTIC HARVEST

Year	Salmon		Halibut		King Crab		Tanner Crab		Shrimp		Totals	
	Metric Tons	Value ($000)	Metric Tons	Value ($000)	Metric Tons	Value ($000)	Metric Tons	Value ($000)	Metric Tons	Value ($000)	Metric Tons	Value ($000)
1969	7,761	2,285	0	0	18,374	8,463	810	178	1,393	123	28,338	11,049
1970	13,595	4,776	0	0	16,065	7,918	1,614	320	2,399	212	33,673	13,226
1971	9,533	3,117	0	0	24,501	12,082	1,113	244	2,868	253	38,015	15,696
1972	4,795	1,997	1,092	1,454	23,961	13,669	1,868	447	8,484	842	40,200	18,409
1973	3,334	1,926	852	1,325	25,845	31,273	3,059	1,084	18,060	2,907	51,150	38,515
1974	1,940	1,890	405	610	30,964	26,392	7,787	3,490	23,548	4,154	64,644	36,536
1975	1,830	1,658	714	1,402	34,121	26,060	7,102	2,121	20,053	3,529	63,820	34,770
1976	9,477	6,417	630	1,744	37,710	51,473	18,000	7,709	31,653	5,924	97,470	73,267
1977	6,488	5,954	1,182	3,302	36,881	77,371	29,640	24,079	34,840	9,135	109,031	119,841
1978	16,464	17,126	867	2,772	49,510	173,579	38,244	38,706	18,779	6,832	123,864	239,015
1979	21,672	32,288	694	2,770	62,244	128,285	39,540	48,962	13,636	5,279	137,786	217,584

[1/] Figures in this table are based on amounts of catch in the Alaska Department of Fish and Game management areas which most nearly correspond to the boundaries of the Aleutian Island Census Division. For salmon, the figures shown are for fish taken in the Alaska Peninsula-Aleutian Islands Management Area. For halibut and shellfish, the figures reflect amounts taken in the Peninsula Management Area, Eastern Aleutians Management Area, Western Aleutians Management Area, and Bering Sea Management Area. Values shown are amounts paid to fishermen.

Source: University of Alaska, Sea Grant Program, October 1980.

The forecast for the domestic fisheries of the area includes a dramatic takeover by U.S. fishermen of the huge foreign harvest of bottomfish, the value of which was estimated earlier at about $500 million in 1978. On the assumption that Americans will totally displace foreigners in this fishery by the year 2000, the population of Unalaska/Dutch Harbor is projected to increase to 13,000 in the year 2000 as compared to only 1,301 persons in 1980.

Although national defense and the fishing industry dominate the cash economy of the area, two other developments have had important influences on the economic well-being of permanent residents of the area. These are the achievement of Alaska Statehood in 1959, and passage of the Alaska Native Claims Settlement Act by Congress in 1971.

Only as a result of Alaska Statehood have area residents achieved access to services long enjoyed by virtually all other Americans, including medical services, education beyond the eighth grade, and improved transportation and communications. Of course, as these services were provided, additional job opportunities were also created in the area. Some of these new jobs appear in Table III.E.2.-1 in the 'State/Local Government' category, while others appear in the 'Services' category. Beginning in 1976 some government-type services, including medical services, were contracted to private nonprofit corporations. Employment in these nonprofit corporations is reported under 'Services' rather than 'State/Local Government'.

The Alaska Native Claims Settlement Act established special corporations, owned by Alaska Natives (Eskimos, Aleuts, and Indians), to administer the land and money awarded to Natives in settlement of their land claims. Native corporations were established for individual villages and also for regions. The boundaries of the Aleut regional corporation coincide almost exactly with the Aleutian Islands Census Division. Beginning in 1973, sizable amounts of money were distributed from the Federal government to the Native corporations. A part of these cash distributions was passed on to individual Natives, providing much needed money income to many who were still relying principally upon subsistence activities for their livelihood. The corporations retained much of the money for investments in order to be able to pay dividends to Native shareholders in future years. In addition to the dividends distributed by the corporations, area residents benefitted by the creation of new wage and salary jobs in the management of the corporations. Many of the positions in the new corporations are filled by Native (Aleut) residents. These jobs appear in Table III.E.2.-1 in the 'Finance, Insurance, and Real Estate' classification.

The new Native corporations have two additional means by which to benefit area residents. One is to finance economic development in activities which would provide employment for area residents. The other is to use the land acquired under the Alaska Native Claims Settlement Act as a means to guide and control development in the fishing and petroleum industries in ways that will benefit area residents while minimizing negative aspects of development.

Economic Base Summary: In 1979, wage and salary employment in the Aleutian Islands Census Division averaged 6,052 jobs. In addition, there were approximately 811 non-wage fishermen, on a twelve-month average basis, bringing the employment total to 6,863 for the year.

The economic base of the area, viewed in terms of sources of money income, consists principally of national defense activities and the commercial fishing industry. The number of active duty military personnel in 1979 was 2,735. When this figure is added to the estimated 397 military-related civilian Federal government jobs the sum accounts for 46 percent of the 1979 employment total of 6,863 jobs in the area. The estimated 811 fishermen together with 1,739 seafood processors make up 37 percent of total employment. Together, national defense and the fishing industry constituted 83 percent of all jobs in the Aleutian Islands Census Division in 1979, exclusive of proprietors and other self-employed persons not involved in the fishing industry. When other jobs indirectly related to national defense or fishing are considered, including jobs in transportation and construction, it is probable that 90 percent or more of the economic base of the area is made up of defense and fishing activities.

Additional components of the economic base of the area include jobs in state and local government and government-type services administered by private nonprofit corporations. These jobs are financed largely by funds received either from the State of Alaska or the Federal government. Those jobs financed by state funding rely mainly on revenues which the state receives from oil and gas development.

The Native regional and village corporations provide employment which is financed in part by Federal payments and in part by state payments based on state oil revenues. These government payments are reimbursements for land taken from the Native (Aleut) people.

Commercial trapping of fur bearing animals provides a small amount of cash income to area residents.

Relatively small amounts of employment are created within the area by the personal consumption expenditures of workers in the activities described above. These jobs are reflected mainly in the figures for 'Wholesale-Retail Trade' in Table III.E.2.1. However, the wholesale-retail trade job totals also include jobs related to military activities and the fishing industry.

The above discussion focuses only on the cash economy of the area, thereby ignoring the important role which subsistence hunting, fishing, and gathering activities have always played in the livelihood of the Aleut residents of the area. Refer to Section III.C.2. of this DEIS for a discussion of subsistence patterns of the area.

A further limitation of the material presented above is the aggregation of employment totals for the entire Aleutian Island Census Division. This method of presentation tends to magnify the importance of the large military establishments at Adak and Shemya Station, even though these installations do not interact in any important way with those communities which may be most affected by OCS petroleum development. The aggregate presentation of employment figures therefore fails to provide a proper perspective for those economic activities which are important to the communities that may be impacted by OCS petroleum development. For this reason, a description of selected communities follows.

St. Paul and St. George: These are the two inhabited islands in the Pribilof Islands group. They are the closest land to the northern one-third of the proposed lease area, and could possibly be used for support and supply bases for OCS petroleum activities or for oil and gas processing facilities (see Secs. IV.A.1.-IV.A.3.).

The total 1980 populations of St. Paul and St. George were 551 and 158, respectively (Table III.E.2.-3.). Except for a small number of U.S. Coast Guard personnel and a few government employees, virtually all residents of the Pribilofs are Aleut.

The most important source of cash income to permanent residents of the Pribilof Islands is the summer harvest of fur seals at St. Paul, which provides 1 to 2 months of wage and salary employment for about 80 permanent residents of St. Paul and 10 permanent residents of St. George. Additional cash income to permanent residents results from a tourist operation which brings nearly 1,000 visitors to St. Paul each year (Johnson, 1978). Employment is summarized in Table III.E.2.-4. Fur trapping is a minor source of cash income to permanent residents. A few wage and salary jobs were created with the Native (Aleut) village corporations for St. Paul and St. George after passage of the Alaska Native Claims Settlement Act in 1971. Small amounts of cash income are also received by the Aleut residents in the form of dividends from the Native regional and village corporations established by the Alaska Native Claims Settlement Act.

The ratio of fulltime or near-fulltime jobs to total population has been estimated at 20 percent for St. Paul and 18 percent for St. George (Management and Planning Services, December 1980). As a basis for comparison, the equivalent ratio for the United States in 1978 was 47 percent. For Alaska, the 1978 ratio was 51 percent. The ratios are based on employment totals which include self-employed persons as well as wage and salary workers (U.S. Bureau of Economic Analysis, 1980).

The low employment ratio helps explain the low per capita income, estimated at $6,410 in 1977 (Table III.E.2.-3.). This figure is about 91 percent of U.S. per capita income in 1977. However, price levels in the Aleutian Island Census Division have been estimated at 182 percent of average U.S. price levels during 1977 (Alaska Department of Commerce and Economic Development, November 1979). If the higher cost of living in the Aleutians area is used to adjust the comparative purchasing power of the $6,410 income, the ratio to U.S. per capita purchasing power would be 0.50 (ibid.). Furthermore, the cost of living in the Pribilofs Islands is almost certainly higher than the average cost of living for the Aleutian Islands Census Division. The cost of living index for the census division was prepared on the basis of all communities in the census division, including military communities where military personnel are able to purchase commodities at government subsidized prices. Many rural Alaskan communities have cost of living indexes substantially in excess of 200 percent of average U.S. living costs (ibid.). It is likely that living costs in the Pribilofs also substantially exceed 200 percent of average U.S. living costs, suggesting that per capita income in St. Paul probably purchases less than half as much as average per capita income in the U.S.

A large share of all food consumed by the permanent residents of the Pribilofs is obtained through subsistence activities (hunting, fishing, trapping, and gathering), or from the carcasses of the fur seals harvested for pelts.

Table III.E.2.-3

ALEUTIAN ISLANDS CENSUS DIVISION[1]
POPULATION AND ESTIMATED PER CAPITA MONEY INCOME BY PLACE

		1970	1980	1970-80 Change:	1970-80 Percent Change:	Estimated Per Capita Money Income	
						1969	1977
1	Adak	4,022	3,313	- 709	- 18	--	--
2	Unalaska	342	1,301	959	+ 280	$2,636	$8,290
3	Sand Point	360	619	259	+ 72	$3,274	$9,483
4	Shemya Station	1,131	600	- 531	- 47	--	--
5	St. Paul	450	551	101	+ 22	$2,290	$6,410
6	King Cove	283	462	179	+ 63	$2,368	$6,830
7	Cold Bay	256	226	- 30	- 12	--	--
* 8	Chignik	83	179	+ 96	+ 116	--	--
9	St. George	163	158	- 5	- 3	--	--
*10	Chignik Lake	117	138	+ 21	+ 18	--	--
11	Akutan	101	126	+ 25	+ 25	--	--
*12	Perryville	94	108	+ 14	+ 15	--	--
13	Atka	88	93	+ 5	+ 6	--	--
14	False Pass	62	65	+ 3	+ 5	--	--
15	Nelson Lagoon	43	59	+ 16	+ 37	--	--
16	Nikolski	57	50	- 7	- 12	--	--
*17	Chignik Lagoon	0	48	+ 48	--	--	--
*18	Ivanof Bay	48	41	- 7	- 15	--	--
19	Attu	0	29	+ 29	--	--	--
20	Belkofski	59	10	- 49	- 83	--	--
21	Squaw Harbor	65	6	- 59	- 91	--	--
other		397	21	- 376	- 95	--	--
Census Division Totals		8,221	8,203	- 18	- 0	$3,317	$7,932

1/ The Aleutian Islands Census Division is the geographic area used by the U.S. Census Bureau for the collection and presentation of data in the 1970 census. The census area used for the 1980 census is similar, except for the exclusion of the five communities indicated above by asterisks (*).

Source: Alaska Department of Labor, January, 1981; U.S. Bureau of the Census, June 1980.

Table III.E.2.-4
Average Annual Full-Time Employment[1/]
St. Paul, Alaska
1980

Classification	Number	Percent
Agriculture, Forestry, and Fishing	1.0	0.8
Mining	0.0	0.0
Contract Construction	0.0	0.0
Manufacturing	1.0	0.8
Transportation, Communication and Public Utilities	1.5	1.2
Trade	18.5	15.1
Finance, Insurance and Real Estate	5.0	4.1
Service	3.5	2.9
Government	92.0	75.1
Federal[2/]	(60.5)	(49.4)
State	(1.0)	(0.8)
Local	(30.5)	(24.9)
Total	122.5	100.0

[1/] Includes self-employed persons and 25 military personnel. (U.S. Coast Guard)

[2/] Includes employment in the fur seal operations, which is administered by the U.S. National Marine Fisheries Service. Also included are 25 military personnel.

NOTE: Figures in the table above do not include employment in subsistence hunting, fishing, and gathering activities, or employment in commercial trapping.

Source: Alaska Consultants, Inc., May 1981.

The relatively small amounts of cash income which permanent residents receive from the fur seal harvest, the tourist business, fur trapping, and Native corporation dividends, are essential for the purchase of commodities such as heating fuel which cannot be provided by subsistence activities. Money is also necessary to purchase boats, motors, motor fuel, guns, and ammunition used in subsistence activities.

Future economic prospects for the Pribilof Islands recently recovered from near disaster as a result of U.S. Senate ratification of extension of the treaty under which the fur seal harvest is conducted. Earlier, there had been political attempts to ban the harvest. (Anchorage Daily News, July 16, 1981.) Establishment of a domestic groundfish operation in the Bering Sea could provide a large additional source of future employment in the Pribilofs. (Alaska Consultants, May 1981.)

Unalaska/Dutch Harbor: This community is the second largest in the Aleutian Islands Census Division, and is by far the largest within the area expected to be affected by the proposed OCS petroleum activity. The population in 1980 was 1,301. (Table III.E.2.-3.) It is very likely that the harbor facilities at Unalaska/Dutch Harbor would be used to provide marine support for the planned offshore petroleum activity.

Although Unalaska originated as a traditional Aleut village, recent increases in fish harvesting and processing have attracted many new immigrants, with the result that Aleuts are now a minority of the total population. (Alaska Consultants, May 1981.) The 1980 population reflects an increase of 280 percent from 1970. (Table III.E.2.-3.)

Unalaska is currently the number one fishing port in the United States in terms of value of landings. (Alaska Consultants, May 1981.) Fish harvesting and processing dominate the local economy. The only other economic activity of major significance is Unalaska's role as a transshipment point for oil and freight to coastal locations in northern Alaska points and for fish products to vessels traveling between the West Coast of the U.S. and the Orient. (Alaska Consultants, May 1981.)

Employment in the community is summarized in Table III.E.2.-5. The employment figures are not adjusted to show the residency status of workers, and include a very large number of seasonal immigrants who participate in fishing and fish processing activities. Fish processing employment makes up virtually all of the employment in the 'Manufacturing' classification. Most employment in the 'Trade' and 'Service' categories are indirectly related to the fishing industry; large amounts of supplies and services from local firms are purchased by commercial fishermen. Most employment in 'Transportation, Communication & Public Utilities' is related either to the fishing industry or to the transshipment role described above.

There are no unemployment statistics available specifically for Unalaska. Unemployment rates for the Aleutian region as a whole are normally low, due in part to the presence of a large transient workforce, which is associated not only with fishing and fish processing but also with military-related construction activities. A similar situation is believed to prevail in Unalaska. According to local officials, unemployment is insignificant among the resident workforce. Almost all jobs in the local processing plants are recruited from

Table III.E.2.-5
Average Annual Full-Time Employment[1/]
City of Unalaska
1980

Classification	Number	Percent
Agriculture, Forestry, and Fishing	150	9.4
Mining	2	0.1
Contract Construction	12	0.8
Manufacturing	1,166	72.9
Transportation, Communication and Public Utilities	57	3.6
Trade	60	3.8
Finance, Insurance and Real Estate	27	1.7
Service	44	2.8
Government	82	5.1
Federal	(9)	(0.6)
State	(10)	(0.6)
Local	(64)	(4.0)
Total	1,600	100.0

[1/] Includes self-employed fishermen and other self-employed, and military personnel.

Source: Alaska Consultants, Inc., May 1981.

outside the Unalaska area and this transient workforce leaves the community after the close of each fishing season. Similarly, most fishermen are not permanent Unalaska residents. Thus, while there is doubtless some seasonal unemployment, it is not as great as the community's overall seasonality of employment might suggest. (Alaska Consultants, May 1981.)

Estimated per capita income for Unalaska was $8,290 in 1977 (Table III.E.2.-3). This is higher than the U.S. per capita income of $7,026 in 1977, but when the high living costs in the area are considered, the average purchasing power was almost certainly much below the U.S. average. The index of living costs in the Aleutian Islands Census Division was estimated at 182 percent of average U.S. living costs in 1977. (Alaska Department of Commerce and Economic Development, November 1979.) If the $8,290 income figure is adjusted by the living cost index, the adjusted per capita income is only 65 percent of U.S. per capita income in 1977.

The discussion above focuses only on the cash economy of the area, thereby ignoring the important role which subsistence activities continue to play in the lives of the Aleut residents. Subsistence activities are discussed in Section III.C.2. of the DEIS.

Future economic prospects are dominated by the expected large scale entry of U.S. fishermen into the gigantic groundfish operations now conducted in the area by foreign fishing fleets. It is possible that a city of 13,000 permanent residents could develop at Unalaska by the year 2000, mainly as a result of domestic groundfish operations. It is expected that Unalaska's transshipment role, discussed earlier, will continue to grow in importance. Economic development will also be influenced by the plans and policies of Ounalashka Corporation, the Native village corporation established under the Alaska Native Claims Settlement Act (Alaska Consultants, May 1981).

Cold Bay: This community is basically an airport enclave populated by Federal and state government officials and airline staffs, plus a minimum of persons performing support function (Alaska Consultants, May 1981). The population in 1980 was 226 (Table III.E.2.-3). Cold Bay offers by far the best civilian airport in the region, with one runway of 1,550 meters (5,100 ft) and another runway of 3,160 meters (10,400 ft), and an almost unlimited capacity to accommodate additional air traffic (ibid.). The airfield is equipped with a full range of navigational aids as well as a modest repair facility, and is encompassed by easily developable land. Consquently, any OCS petroleum activities in the region will probably use Cold Bay as the main center for air support (Tremont, April 1981).

In addition to air transportation activity, economic activities in Cold Bay include a recently established king and tanner crab operation, which utilizes the air transportation facilities to move processed crab to distant markets. A small amount of tourism at Cold Bay is based on visits by sportsmen hunting caribou, brown bear, and water fowl. There are 17 military personnel and 30 resident civilian employees at the Cold Bay Air Force Station. Headquarters for the Izembek National Wildlife Range, and a state operated fish hatchery are also at Cold Bay (Alaska Consultants, 1981).

Employment is summarized in Table III.E.2.-6. Employment figures in this table include jobs held by seasonal immigrant workers in fishing and fish processing. The fish processing jobs make up all of the employment reported in the 'Manufacturing' category.

Future economic prospects, in addition to possible OCS petroleum activities, include expansion of the king and tanner crab operation and possible addition of shore-based salmon processing. The small tourism operation is capable of further increases (Alaska Consultants, May 1981).

The Pribilof Islands, Unalaska/Dutch Harbor, and Cold Bay are the only inhabited places in the Aleutian Islands Census Division likely to be affected in a positive way by increased economic activity resulting from proposed OCS petroleum development. Other communities in the census division would, if affected at all, be affected only in a negative way by possible damage to commercial fishing resources or subsistence resources. Communities which depend heavily on subsistence activities are described in section III.C. of this DEIS.

Other Communities: The small fishing villages within the census division are described in Section III.C.3. Two larger communities which depend upon commercial fishing activities are King Cove and Sand Point, both located on the south side of the Alaska Peninsula. The 1980 population of Sand Point was 619, and the population of King Cove was 462 (Table III.E.2.-3.) No detailed description of the economies of these two communities is provided, since the only point of interest is that any significant damage to commercial fishing resources caused by OCS development would probably harm the economies of these communities (Alaska Consultants, February 1981).

Future Environment Without OCS: For the Aleutian Islands Census Division as a whole, Table III.E.2.-7 shows forecasts of the population and employment which are expected in the absence of OCS petroleum development activity. The very large population and employment increases are projected mainly on the basis of one key assumption: that the huge foreign harvest of bottomfish from waters adjacent to the Aleutian Island Census Division will be entirely displaced by the domestic fishing industry by the year 2000. This development is expected to create many thousands of jobs both onshore and offshore.

F. Transportation Systems

The transportation systems and facilities of the subject areas are both rudimentary in nature and sparse in distribution. Developed deep water harborage is limited entirely to the Unalaska/Dutch Harbor area, while only the Cold Bay airfield is capable of servicing standard-size jet aircraft. Roadways, both paved and unpaved, seldom extend beyond the jurisdiction of the regions settlements and contribute little to the flow of regional commerce. Indeed, because of its irrelevance to regional transportation patterns and hence to OCS activities, a discussion of the road systems of the affected area is not included in this section.

Described in this section are the transport characteristics of those particular areas which are most likely to be impacted as a result of the proposed action. In order of their coverage, they are: the Pribilof Islands, Dutch

Table III.E.2.-6
Average Annual Full-Time Employment[1/]
Cold Bay
1980

Classification	Number	Percent
Agriculture, Forestry, and Fishing	25.0	5.0
Mining	0.0	0.0
Contract Construction	0.0	0.0
Manufacturing	30.0	15.0
Transportation, Communication and Public Utilities	56.5	28.3
Trade	6.0	0.3
Finance, Insurance and Real Estate	0.0	0.0
Service	9.0	0.5
Government	73.0	36.6
Federal	(49.5)	(24.8)
State	(19.0)	(9.5)
Local	(4.5)	(2.3)
Total	199.5	100.0

1/ Includes 17 military personnel and 30 civilians residnet at the Cold Bay Air Force Station.

Source: Alaska Consultants, Inc., May 1981.

Table III.E.2.-7
Population and Employment Projections in the Absence of OCS Activity
Aleutian Islands Census Division: 1981 - 2000

Year	Population Resident Civilian	 Total[1/]	Total Employment
1981	3,777	10,595	6,523
1982	4,169	11,565	7,383
1983	4,239	11,659	7,478
1984	4,447	11,888	7,602
1985	5,056	13,077	8,485
1986	5,316	13,373	8,718
1987	6,179	14,774	9,680
1988	7,295	16,379	10,801
1989	8,712	18,279	12,090
1990	10,860	20,875	13,727
1991	13,551	24,370	16,076
1992	15,092	25,780	17,020
1993	18,934	30,257	19,621
1994	22,343	33,876	21,932
1995	23,423	34,643	22,539
1996	27,939	39,206	24,748
1997	30,961	42,219	26,712
1998	34,501	45,456	28,374
1999	38,199	49,001	30,322
2000	41,597	52,040	31,926

[1/] Population figures in Column 2 differ from those in Column 1 by including military personnel and their dependents, Federal government civilian employees in defense related jobs and their dependents, and non-resident construction workers, non-resident fishermen, and non-resident fish processing workers who work in the Aleutian Islands Census Division a part of each year but maintain residences outside the census division.

Source: University of Alaska, Institute of Social and Economic Research (Projections produced using the SCIMP model, and originally reported in OCS Technical Report No. 57).

Harbor/ Unalaska (both marine and air facility), Unimak Pass, the Cold Bay airfield, and the embayments located on the south shore of the Alaska Peninsula.

St. Paul Island:

Marine Facilities and Commerce: Marine facilities on St. Paul Island are limited. There are two small docks on the island, neither of which is attended by warehouse or storage facilities. One of the docks is located at Village Cove; it functions as the principal conduit for the Islands commerce. The second facility is located at the east end of the island and is used only when weather conditions prohibit the use of the Village Cove dock. The Village Cove pier is composed of reinforced concrete, has a dock face of 3.4 meters (100 ft) and lies in water depths of .9 to 1.2 meters (3-4 ft) (MLLW). Due to the nearshore shallow water depths, all cargo must be lightered ashore by power barge or bidarkas (native skin boats).

During 1980, St. Paul was visited seven times by either supply barges or freighters. During 1978, 4,175 tons of goods passed through St. Paul harbor. The bulk (97%) were inbound commodities.

Petroleum accounted for 58.8 percent of the total inbound tonnage while the remaining tonnage was distributed between food products (13.6%) lumber, wood, and furniture (10.5%), building products and other commodities (7.4%). Outbound commodities were (and still are) primarily seal skins and carcasses. No marine passenger service exists to the Island.

Navigation of the waters around St. Paul Island can be difficult. The climate of the area is characterized by dense fog and high winds. The winds are not constant from any direction and between the months of September and March, gales may blow from any direction. Existing anchorage at St. Paul seems to be west of Village Cove between Zapodni Point and Reef Point where water depths reach 18.3 meters (60 ft).

Air Facilities and Service: St. Paul airport has a 1,547 meter (5,075 ft) by 46 meter (150 ft) runway constructed during World War II. It is surfaced with hard-packed volcanic material (scoria) and cannot accommodate jets.

The airport is located about 4.8 kilometers (3 mi) northeast of the community of St. Paul and is 362 kilometers (225 mi) northwest of Cold Bay.

The airport's main limitation has to do with climate. Heavy fog is prevalent from May through August. Flying under VFR conditions is possible less than 35 percent of the time in summer and less than 82 percent of the time from October through December. When ceiling and visibility are most favorable for flying, strong and gusty winds are most likely to occur.

The airport is owned by the National Marine Fisheries Service (NMFS). There is no terminal building or hangars at the airport and no maintenance or repair facilities. Fuel is available only from the NMFS. The runway is equipped with medium intensity lights, a rotating beacon, a lighted wind sock, an approach light system and NDB approach.

Scheduled passenger service is provided three times a week by Reeve Aleutian Airways. Flying time from Cold Bay is 1 hour and 10 minutes. Type of aircraft used on this run is the L-188 AC (turbo prop). From St. Paul, the aircraft flies back directly to Anchorage, a distance of about 1,208 kilometers (750 mi). Statistics from the CAB activity indicate that the number of passengers arriving and departing from St. Paul Island via Reeve Aleutian Airways has been steadily climbing since 1974 while freight tonnage has been declining. In 1974, 1,329 passengers and 59 tons of freight passed through the airport. By 1979, these figures had respectively increased to 2,335 passengers and declined to 41 tons of freight.

Charter flights to St. Paul are available from many operators (the main one being Peninsula Airways). They provide a variety of load capabilities, prices, and aircraft types.

St. George Island Transportation Systems: The village on St. George Island has only minimal transport facilities. The village of St. George is served by a small shallow water dock, which is not attended by any warehouse facility, and a 700 meter (2,300 ft) gravel runway which is maintained by NMFS. Because of the shallow waters surrounding St. George, marine freight must be lightered in from supply ships. Air cargo bound for St. George is deplaned at the St. Paul airfield and then lightered across to St. George.

Dutch Harbor/Unalaska: Marine Facilities and Commerce: The city of Unalaska is host to a natural harbor which is centrally located on Alaska's Pacific and Bering Sea fishing grounds. It is the only developed deepwater port in the area under study. The city possesses three major moorages: Dutch Harbor, Iluiluik Bay, and Captains Bay (see Fig. III.H.3.b.-3).

Dutch Harbor: Dutch harbor has two principal docks. One is the Sea-Land city dock on the northwest side of the bay under Mt. Ballyhoo. The other facility lying to the southeast of the city dock is the Standard Oil dock.

The Sea-Land city dock is part of a two-phase construction project. A temporary dock was built in 1979 by Sea-Land. The dock is a T-shaped facility with a 9 by 55 meter (30 ft x 180 ft) loading face. Depth along the face of the facility is estimated at 9.1 meters (30 ft). The city of Unalaska owns the land at the site of the city dock; however, Sea-Land owns the temporary dock facility itself. The city of Unalaska proposes to build a new dock in two phases. Upon completion, Sea-Land is expected to abandon their temporary facility and lease space (in the form of tariffs) from the city. Tariffs have not been established (Ere Systems, 1981).

Sea-Land currently handles only containerized cargo in the form of dry or refrigerated containers. The temporary facility has the capacity to berth a barge carrying 280 vans. They can unload or load approximately 10 to 12 vans per hour and there is little or no waiting time for the barges because their arrival is scheduled in advance. There is no equipment or covered storage facilities available on site. The barges carry clawer cranes on deck which are used for unloading or loading of the containers. Open storage is available adjacent to the docking facility that will accommodate approximately 100 containerized vans (CV), plus Sea-Land has leased storage space from American President Lines to store an additional 100 CV's (Lindsey, 1981). The city wharf project will go to bid in the spring of 1981. The first phase of the project will be a 14.6 by 61.0 meter (48 ft x 200 ft) pier facility. The second phase of the facility would add an additional 61 meters (200 ft) of wharf bringing the wharf face to 122 meters (400 ft). Depth along the facility will be 13 to 15 meters (42-60 ft). No covered storage is planned at this time for the facility.

The Standard Oil dock is owned by Standard Oil. It is a T-shaped facility extending approximately 122 meters (400 ft) from shore. The dock face is approximately 102 by 15 meters (334 x 50 ft) with water depths alongside the dock of 9.4 to 11.6 meters (31-38 ft) at mean lower low water (MLLW). The dock can refuel six average size vessels (36.6 meters or average length) in a given period.

The dock is primarily a refueling base and boasts of having the second largest throughput of liquid petroleum (60 million gallons annually) in the U.S., next to Valdez. However, small amounts of general cargo are offloaded at the dock and picked up directly by the persons owning the commodities.

Adjacent to the docking facilities is a number of petroleum storage tanks. In total, the facility has a storage capacity of 13 million gallons. It is refueled by 35,000 DWT tankers that are brought in as needed; however, this facility is generally refueled in early October in anticipation of the crab season. The 35,000 DWT tankers cannot offload their petroleum products at the Standard Oil dock because the water depth is insufficient to handle these vessels. The oil tankers are anchored .8 kilometers (.5 mi) offshore and Crowley Maritime lighters the petroleum products to the Standard Oil dock. It takes approximately 60 hours to offload a tanker. It takes approximately 8 hours to load a lighter, 14 to 16 hours to unload the same lighter, and it requires approximately 2.5 trips to unload a 35,000 DWT tanker.

The Standard Oil dock is the primary fuel depot for the fishing industry and serves the fuel needs of all Alaska communities north of the Aleutian Chain. Most fuel is used primarily for domestic fisheries and Alaskan communities, however, an average of four foreign ships refuel at this facility per year (Norton, 1980). Foreign vessels traveling in this area usually carry enough fuel to return to their home ports.

Iliuliuk Bay/Harbor: The water body known as Iliuliuk Bay contains one major marine facility (American President Lines Dock) and a host of fish related dock facilities. They include East Point Seafoods, Whitney-Fidalgo, Universal Seafoods (Unisea), Pacific Pearl, and Pan Alaska Fisheries. Each fish processor has its own dock facilities.

The American President Lines (APL) is a recently completed facility that includes a dock measuring approximately 107 by 46 meters (350 x 150 ft). The dock has access to shore from both ends of the dock face. In addition, a fishing pier was constructed at the northwest end of the APL dock face which is owned by the Native corporation. They have the ability to moor fishing vessels up to 61 meters (200 ft) in length. Depth along the APL dock face is 10.7 to 13.1 meters (35 to 43 ft). The dock face is capable of mooring pacesetter class ships and L-5 class ships that range in length from 184 to 204 meters (604-669 ft). Handling equipment includes a Paceco 105T Gantry Crane similar to the type utilized at the Port of Seattle. This crane has the ability to move up from 30 to 35 containers per hour which is three times the number of moves that the conventional crawler cranes can make. In addition to this large crane, there is a 3100 Manitowac container crane capable of 10 to 12 moves per hour plus several other smaller cranes, tractors, and forklifts.

This facility is jointly used by APL and Foss Alaska Launch (FAL) who lease onshore space from APL and pay a tariff for the use of the dock facility. The entire facility, both onshore and offshore, belongs to the Native corporation and is leased by APL, who in turn subleases a portion of their space to FAL at the dock facility and a storage area to Sea-Land which is approximately 1.6 kilometers (1 mi) from the facility. APL leases approximately 2.5 hectares (6.1 acres). Approximately 1.4 hectares (3.6 acres) are located adjacent to the dock and another 1 hectare (2.5 acres) is located 1.6 kilometers (1 mi) to the northwest directly behind the Standard Oil dock. The latter facility is an open storage yard which is used solely for the storage of containers. This yard will hold approximately 140 containers stacked one high (Double stacking of loaded vans is possible).

In addition to containerized cargo, the facility does handle limited amounts of neo-bulk cargo. Neo-bulk service is a dock to dock service requiring customers to pick up their goods at the dock upon arrival. FAL does plan to use the storage buildings as a "will call" for neo-bulk commodities.

The fish processing docks are used primarily for loading and unloading fish products. However, these docks do handle limited amounts of neo-bulk cargo. The Western Pioneer and Alaska Shipping Company offload cargo at these facilities. The cargo is generally commodities ordered by the fish processors themselves; however, cargo destined for residences of Unalaska is also offloaded at these facilities. These carriers provide a dock to dock service and there is no provision for storage of cargo for Unalaska residences at any of the fish processor docks. These carriers may drop cargo off at each processor in a single trip.

Captains Bay: Crowley Maritime owns and operates a dock facility at Captains Bay called the Captains Bay Tank Farm located approximately 3.3 kilometers (2 mi) southwest of Unalaska. Crowley uses this facility for a staging area and transshipment point for military resupply operations in western Alaska. The dock facility is a T-shaped pier extending approximately 152 meters (500 ft) offshore with a dock face of 107 meters (350 ft) (Wazola 80). Depths along the dock face range from 11 to 12.8 meters (36-42 ft). The pier was built in 1940 by the Corps of Engineers and was partially reconstructed in 1975. Onshore there are three large storage sheds. Each shed has tow storage bays measuring approximately 18 by 24 meters (60 x 80 ft). One of the storage sheds is leased to Pacific Pearl Fisheries on a temporary basis. There are four oil storage tanks with a capacity of 10,000 barrels or 406,489 gallons each. The storage tanks are above-ground, vertical tanks located onshore approximately 79 meters (260 ft) from the dock. Fuel is offloaded from oil tankers and pumped through a 274 meter (900 ft) buried pipe to the onshore tank storage. Onshore handling equipment include a Manitowac crane, forklift, and a variety of trucks and related equipment.

This facility is usually operated from May 15 through October 15. However, it could become available year-round. The typical barge that uses this facility is typified by Crowley's barge 101 which is approximately 23 by 91 meters (76 x 3[illegible] ft) with a capacity of 100,000 barrels of petroleum products. A maximum of three tugs are served per week during the summer season and only one tug and barge can be handled at a time at the dock. Barge delivery to the facility averages approximately one time per month during the season (Lindsey, 1980).

Navigational Characteristics: The entrance to Iliuliuk Bay and Dutch Harbor from the northwest is approximately 0.8 kilometers (0.5 mi) wide and 29.3 to 32.9 meters (96-108 ft) deep. During spring and fall gales, the bay is subject to violent williwaws, making anchorage dangerous. Vessels forced to moor at the Standard Oil dock during the early spring and fall find it necessary to use wire chains and cables in addition to mooring lines during severe gales.

Iliuliuk Harbor, at the head of Iliuliuk Bay, offers better protection than Dutch Harbor, however, this area is also subject to violent gales. During August 1980, winds blew through the area in excess of 161 kilometers per hour (100 mph) destroying sections of the old submarine dock and overturning boats up to 12 meters (40 ft) in length.

Pilotage is required for all foreign vessels navigating the island waters of the state of Alaska. The mean range of tide is .67 meters (2.2 ft), diurnal range is 1.13 meters (3.7 ft), and extreme range is 2.77 meters (9.1 ft). The tidal current in Dutch Harbor is inappreciable, and in Iliuliuk Harbor the velocity does not exceed 1 knot.

Iliuliuk reef, extending 229 meters (250 yd) in an east-west direction at the mouth of Iliuliuk Harbor, is a navigation hazard. The reef is bare in places, however, the majority is covered by kelp. The channel between Iliuliuk Bay and Harbor called east channel, has a controlling depth of 6.7 meters (22 ft) and the south channel has a controlling depth of 8.5 meters (28 ft).

Iliuliuk Harbor, while small, offers a good holding ground for vessels; it has an average depth of 18.29 meters (60 ft) and there is sufficient room for a moderate size ship (up to 61 m or 200 ft) to maneuver. Violent williwaws are experienced with southern gales. Vessels under 61 meters long have ridden out gales, but the short scope of chain allowable usually causes the anchor to drag. Because of limited swinging room in Iliuliuk Harbor, anchorage in Dutch Harbor or Unalaska Bay is recommended by the U.S. Coastal Pilot during severe weather. During the fishing season, this area becomes very congested due to the concentration of fishing boats offloading fish at fish processing plants. Captains Bay is the most exposed of the three areas, however, anchorage is available in water depths from 31 to 36 meters (102-120 ft).

Winds are variable and often strong. Southeasterlies are prevalent on the north side of Unalaska Island from November through February. Winds of 65 knots have been recorded at Dutch Harbor. Precipitation generally occurs on 200 to 300 days of the year in the Aleutians. At Unalaska, the average rainfall is 1.47 meters (58 in) and when snowfall is included, reaches 2.06 meters (81 in). There are many days with snow, drizzle, and fog. A significant weather element that occurs during peak vessel traffic (at the start of crab season) in this area is the decline in visibility in August from 25.3 nautical miles to 5.3 nautical miles. The poorest visibilities in Alaska occur along the Aleutians. Visibility is best in the winter; however, even then it can be hampered by fog, snow, and rain, making navigation difficult.

Facilities Usage: Ships can offload and load cargo at a variety of docks located in the Unalaska/Dutch Harbor area. Lightering is only required to offload 35,000 DWT oil tankers at the Standard Oil dock. Table III.F.-1 illustrates the annual level of vessel activity in Iliuliuk Harbor (Corps of Engineers includes all docks under this designation) for the period 1972 through 1978. These numbers include all types of vessels - commerce, fishing, domestic, and foreign. Specific statistics are not available, however, the vast majority of these vessels are fish-related. This would account for the dramatic drop in the number of outbound dry cargo vessels from a high of 929 in 1974, to a low of 85 in 1976. Because of the increase catch in the fish over the past 3 years, it is estimated that 1980 levels of vessel activity may exceed the 1974 level.

Foreign vessels account for a large percentage (exact data is not available) of the total vessel activity entering and leaving Iliuliuk Harbor. According to the U.S. Customs Service, 321 foreign vessels entered this harbor during 1980. Table III.F.-2 illustrates foreign vessel activity by month for 1980 and shows foreign vessels that originated from a U.S. port and vessels originating from foreign ports.

The U.S. Customs monitors (from Unalaska) all foreign vessels operating in western Alaska on both sides of the Aleutian Chain, west of Kodiak. All foreign vessels entering U.S. waters must check in at the Customs in Unalaska and obtain a permit. Many vessels have no business in Unalaska and enter this port for the sole purpose of checking with Customs.

The majority of foreign vessels are trampers that range to 6,000 gross tons (Ere Systems, 1981).

Throughput tonnage for the period 1968 through 1978 is illustrated in Table III.F.-3a. This table illustrates a rapid growth in throughput between 1968 and 1978; approximately 214 percent. This is due to the rapid increase in receipts and shipments of petroleum products from the Standard Oil dock and Crowley Maritime operations. In 1976, petroleum products accounted for 91.2 percent of throughput tonnage and this increased to 93 percent in 1977, however, decreased as a percentage of total throughput tonnage to 88 percent in 1978. Table III.F.-3b shows total throughput tonnage by commodity group between 1972 and 1978. It is clear that petroleum products dominates throughput tonnage in Iliuliuk Harbor. Throughput tonnage of petroleum products has increased by 92 percent or by 159,780 tons between 1972 and 1978. Throughput tonnage on fish and shellfish peaked in 1974 with 61,429 tons and dropped to a low of 6,226 tons (1977) during this period.

Dutch Harbor:

Air Facilities and Commerce: The Dutch Harbor airport is presently classified as part of the state system of secondary airports. The airport is located on Amaknak Island, adjacent to Unalaska Island, and is within the city limits of Unalaska. The existing gravel runway is 1,311 by 30 meters (4,300 x 100 ft) and was originally built by the Navy during World War II.

The airport has several limitations. The main one is that the length of the runway precludes it from handling larger aircraft. Extending the runway would be expensive because it would mean extending overfilled land. Another limita-

Table III.F.-1

Iliuliuk Harbor Vessel Activity
1972-1978

Year	Inbound			Outbound		
	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Tow or Tug
1972	709	58	50	712	59	53
1973	707	26	27	708	28	27
1974	928	20	52	929	21	52
1975	877	60	43	975	62	42
1976	89	64	85	85	66	86
1977	150	54	63	147	45	67
1978	225	32	78	214	41	73

Source: Corps of Engineers, Waterborne Commerce Statistics.

Table III.F.-2

Foreign Vessel Activity Iliuliuk Harbor
1980

Month	Originating from U.S. Ports	Originating from Foreign Ports
January	1	5
February	1	15
March	9	20
April	6	18
May	17	23
June	10	34
July	28	27
August	7	18
September	5	19
October	15	20
November	0	14
December	4	5
TOTAL	103	218

Source: U.S. Customs, Anchorage, Alaska.

Table III.F.-3a

Iliuliuk Harbor Throughput Tonnage
1968-1978

Year	Tonnage
1968	120,980
1969	262,905
1970	251,163
1972	190,109
1973	163,586
1974	157,477
1975	300,953
1976	349,760
1977	342,324
1978	379,293

Source: Corps of Engineers, Waterborne Commerce Statistics 1968-1978.

Table III.F.-3b

Iliuliuk Harbor Throughput Tonnage 1972-1978

Year	Petroleum[1] Products	Food[2] Products	Fish[3] Shellfish	All Other[4] Commodity Groups	Annual Total
1972	173,460	36	14,508	2,105	190,109
1973	144,555	3,224	13,086	2,271	163,586
1974	88,790	3,237	61,429	4,021	157,477
1975	272,222	5,598	20,563	2,570	300,953
1976	321,290	9,241	15,738	3,591	349,760
1977	318,298	10,813	6,226	6,987	342,324
1978	333,240	6,053	28,329	10,879[5]	378,501

1/ Includes gasoline, jet fuel, fuel oil and miscellaneous petroleum and coal products.

2/ Includes salt, prepared fish, alcoholic beverages, groceries, and miscellaneous food products.

3/ Includes fresh fish and fresh shellfish.

4/ Includes all other commodities.

5/ Excludes local dock to dock transfer - 396 tons shipped and 396 tons received.

Source: Corps of Engineers, Waterborne Commerce Statistics, Part 4.

tion is the safety hazard created by the 23 to 26 meters (75-85 ft) high bluff located approximately 30 meters (100 ft) northeast of the runway centerline. Further, the mountainous terrain on Amaknak and other nearby islands creates navigational hazards, especially during poor visibility conditions. Taking off east-southeast from the runway is particularly hazardous due to a mountain located on Unalaska Island about 2.42 kilometers (1.5 mi) from the end of the runway.

Facilities at the airport include an old terminal building, now exclusively used by Reeve Aleutian Airways. Other facilities include a hangar, half of which is presently occupied by a tenant and the other half is being held vacant pending a Coast Guard offer to occupy. There is an underground storage tank for fuel.

Annual aircraft operations for the Dutch Harbor airport is forecast to average around 2,000 during the first part of the 1980's and climb to 3,000 by the end of the decade (DMJM, 1980). This forecast, however, does not assume a large scale of oil or gas discovery. Freight moved by all carriers was estimated at 159 tons in 1979, with 109 tons of this total moved by scheduled carriers. Freight statistics for the subject air facility have sharply decreased since 1975; however, enplaned passenger totals have increased from a 1974 low of 3,878 to a 1979 high of 11,660 (CAB Airport Activity Statistics, Annual).

Major scheduled passenger service to Dutch Harbor from Anchorage via Cold Bay, is provided daily, except Sunday, by Reeve Aleutian Airways. There is also a scheduled cargo flight from Anchorage, via Port Heiden, every Wednesday. For both the passenger and cargo scheduled flights, the aircraft used is the Nihon YS-11. Every Tuesday, except Memorial and Independence Days, there is a flight from Port Heiden to Anchorage. Equipment used on this route is a Grumman G-21A. Flight time between Anchorage and Dutch Harbor is approximately 4 hours and between Cold Bay and Dutch Harbor about 55 minutes on a YS-11.

Other scheduled and/or charter services from Unalaska to outlying Aleutian villages such as King Cove, Akutan, and False Pass are provided by amphibian aircraft owned by Peninsula Airways under contract to Reeve Aleutian Airways. Peninsula Airways, headquartered at Pilot Point, also holds portal services contract for smaller Aleutian communities.

Makushin Bay: Makushin Bay is a large and deep embayment located a few air minutes west of Dutch Harbor. Although the bay contains no facilities of any type, it does possess deep, protected anchorage. Additionally, along its shoreline are located modest amounts of developable land. Water depths within the Bay are, in general, greater than 30 meters (100 ft).

Unimak Pass: The Unimak pass at its narrowest point between Ugamak and Unimak Island is approximately 19 kilometers (12 mi) wide. A subsidiary pass, it is approximately 6.5 kilometers wide (4 mi) and is located immediately west of the island of the same name. Geographically, the Unimak Pass represents the principal portal through which U.S. generated traffic will enter the Bering Sea region. Navigation within the Unimak Pass area is usually complicated by storms and heavy fog as the pass area possesses a climate not unlike the rest of the Bering Sea.

Current vessel use of the Unimak Pass is difficult to estimate. The pass forms part of the great circle shipping route that links the orient with the west coast of North America and as such, is subject to passage by numerous cargo and fishing vessels. No agency or individual has as yet launched an effort to determine the exact number of vessels annually transiting the pass. The estimates used in this sub-section come from three sources: the size and movement characteristics of the Bering Sea fishing fleet; foreign vessels which have anchored in Unalaska and have been noted by the U.S. Customs Service; and U.S. cargo, tug, and barge vessels whose appearance in Unalaska has been recorded in the U.S Army Corps of Engineers port statistics. It is recognized that these sources represent only a portion of the traffic which transits the pass. They are used only to establish some quantifiable parameter against which to measure the impacts of the proposed action. The fishing fleet which operates out of Unalaska/Dutch Harbor on a seasonal basis has been estimated at between 450 and 500 vessels (Careaga, 1981). Most of these vessels have registered home-ports outside the area and gain entrance to the area through the pass. A multiplier of 2.5 has been assumed as a rough determination of the usage of this pass by the fleet. Foreign vessel traffic may be separated into two categories (see Table III.F.-2): traffic originating at U.S. ports and those originating at foreign ports. Using Table III.F.-2 as a guide, we assume that all foreign traffic from U.S. ports via Unimak Pass and at least one-half of the traffic originating from foreign ports transits Unimak Pass. In regard to U.S. non-fishing vessel traffic, a figure of 1.5 is used for all inbound Unalaska traffic to determine this class of carriers use of the pass (Table III.F.-1). Using 1978 Iliuliuk harbor vessel statistics in concert with foreign vessel and U.S. fishing fleet statistics, one could conservatively estimate Unimak Pass vessel transits from these sources to be around 1,800 to 2,000 per year.

However, given the growth of the fishing industry in the Unalaska/Dutch Harbor area, it may well be that 1978 Iluiluik harbor vessel statistics are below present usage of those facilities and, as a result, the figure of 1,500 transits cited in the previous sentence is actually lower than the current vessel traffic.

Cold Bay Airfield:

Facilities Usage and Commerce: The airport is located on the west shore of Cold Bay, 625 air miles southwest of Anchorage on the Alaska Peninsula. Landing facilities at Cold Bay airport consist of two asphalt runways; one is 1,562 by 46 meters (5,162 x 150 ft), where as the other runway is 3,174 by 46 meters (10,415 x 150 ft).

The airport is owned and operated by the state of Alaska. Terminal facilities include flight service station, quonset huts for storage and minor maintenance, a post office, and a general store. Fuel storage in tanks are located near the city docks owned by the USAF (42,000 gallons diesel); Standard Oil (75,000 gallons diesel); and the state of Alaska (22,500 gallon diesel and gasoline). In addition, Standard Oil has facilities for storing 4 million gallons of jet fuel.

Table III.F.-4 indicates the general traffic levels experienced by the Cold Bay airport. Of interest is the fact that despite the fall in freight tonnage moved through the airport since 1974, the number of passengers enplaned has sharply risen during the same periods.

Table III.F.-4

Traffic Data for Cold Bay Airport

Year	Enplaned Passengers	Freight (Revenue Tons)	Mail (Revenue Tons)	Airline	Scheduled Service	Non-Scheduled Service	All Services	Departures Scheduled	Scheduled Departures Completed	Percent of Departures Scheduled
1974	6,488	814.38	244.17	RV[1]	1,291	195	1,486	1,059	910	85.93
1975	6,877	338.95	301.82	RV	1,251	47	1,298	1,138	887	77.94
1976	7,942	427.93	252.33	RV	1,244	56	1,300	982	894	91.03
1977	9,233	293.21	182.71	RV	1,021	11	1,032	961	821	85.43
1978	10,436	240.77	177.13	RV	1,146	7	1,153	949	925	97.47
1979	21,216	398.25	327.91	RV	1,272	13	1,285	1,137	1,080	94.98

[1] RV = Reeve Aleutian Airways

Source: CAB Airport Activity Statistics, Annual.

The runway length is adequate to serve existing and forecasted traffic through 1990. The FAA has forecast an increase of 50 percent in air carrier operations and 100 percent in air taxi operations between FY 1978 and FY 1990. Through FY 1990, FAA has recommended construction of a new terminal and acquisition of a Crash and Fire Rescue (CFR) vehicle. Air navigation and air traffic control facilities planned through 1990 include an ODAL (omnidirectional Approach Lights) on Runway 14-32.

Scheduled service to Cold Bay from Anchorage or Seattle is provided only by Reeve Aleutian Airways. They fly three times (twice between November 15 and May 1) per week from Seattle using Lockheed L-188 Electra.

In addition to Reeve Aleutian Airways, Flying Tiger Service's cargo flights stop here on their way to the Orient and back. Reeve Aleutian does not have any scheduled cargo-only flights to Cold Bay from either Anchorage or Seattle.

Main air taxi services are provided by Peninsula Airways (Pilot Point); Airpac Inc. (Dutch Harbor); and Gifford Aviation (Anchorage).

Recent action by the CAB tenatively granting rights for a number of airlines to initiate service into the Aleutians and the Pribilofs, and their consideration of yet other requests for similar routes, may increase service to Cold Bay, Dutch Harbor, and St. Paul. Airlines desiring to provide service to Cold Bay and Dutch Harbor include Great Northern Airlines and Kodiak-Western Alaska Airlines.

The breakdown of 8,000 operations in FY 1978 for the Cold Bay Airport is as follows:

Air Carriers	25 percent
Air Taxi	13 percent
General Aviation	50 percent
Training (Touch and Go)	12 percent
	100 percent

Major limitations of the Cold Bay Airport are due to the climatological factors and to the characteristics of airport facilities and services.

Cold Bay's climate is maritime with not much variation between mean maximum and minimum temperatures. On the average, the sky is overcast or obscured 50 percent of the time throughout the year. Generally visual flying (VFR) is not possible 20 percent of the time. In the three summer months, fog is frequent and VFR conditions exist about 60 percent of the time or less. Strong and hazardous winds (28 knots or higher) occur year round but are most frequent in fall and winter when conditions for flying otherwise are most favorable.

Southern Shore of the Alaska Peninsula: Apart from the Pribilof Islands and Makushin Bay, the southern shore of the Alaska Peninsula is the site of at least four bays which could host a major oil and/or gas processing terminal. These bays from south to north are Ikatan Bay, Morzhovoi Bay, Cold Bay, and Pavlof Bay. The location of these bays can be found on any large color graphic contained in this document. Except for the Cold Bay airfield, none of these aforementioned bays have transport facilities which could be of service in promoting St. George Basin exploration and development activities. Indeed, these areas are largely unpopulated. Any needed support infrastructure or processing facilities would have to be constructed by industry from the ground up. Each of these four bays are plagued by some physical drawback, all of them could be made serviceable through extensive dredging and grading efforts. Of the four bays, Ikatan seems to offer the fewest navigational obstacles. Additionally, Ikatan Bay is the only potential facility site location discussed within this section which is not in or enclosed by a national wildlife refuge. A corridor of land, which is in interim conveyance to the Aleut Corporation, connects Ikatan with Bristol Bay. This corridor parallels and includes the south shore of False Pass. Ikatan's major physical drawback may be its derth of easily developable land.

Morzhovoi Bay is located north of Ikatan Bay. Insofar as physical characteristics are concerned, Morzhovoi is superior to the other three Alaska Peninsula bays. Morzhovoi has a large, natural, deepwater harbor with sufficient adjacent land for shore facilities. Deepwater moorage begins some 914 to 1,820 meters (3,000-6,000 ft) offshore. Assuming a landfall on the Bristol Bay coast, only 5 to 13 kilometers (3-8 mi) of pipeline, constructed over generally flat terrain, would be needed to reach the site. The western shore of Cold Bay and the peninsula extending south of the bay seems to offer several terminal sites. Adequate water depths of 18 meters (60 ft) generally lie between 762 and 1,524 meters (2,500-5,000 ft) offshore. The Cold Bay area is characterized by flat terrain, and only some 16 to 19 kilometers (10-12 mi) of overland pipeline from Bristol Bay would be required to reach a Cold Bay site. Harbor characteristics of Pavlof Bay are generally adequate, and land suitable for facility development is present. It would require a 40- to 50-kilometer overland pipeline (25-35 mi) to reach Pavlof Bay. Adequate anchorage for potential crude carriers lies some 914 to 1,524 meters (3,000-5,000 ft) offshore. Navigational hazards which are found in the approach to this harbor may present some potential difficulties. It is important to realize that any potential support vessel issuing from them would have to enter the Bering Sea via Unimak Pass. False Pass is truly indicative of its name and would not offer safe transit to support vessels. Therefore, these bays will not be considered as sites for marine support bases.

G. Coastal Zone Management

1. State Coastal Zone Management Program: The pressure to recognize and protect the valuable coastlines of the United States came to a culmination with the passage of the Federal Coastal Zone Management Act (P.L. 92-583) (CZMA) of October 27, 1972. Substantial amendments modified the act as of July 26, 1976 (P.L. 94-370). The CZMA provides for a state coastal zone management program oriented towards identification of coastal resources within the state, development of appropriate new policies, or reworking of existing policies designed to manage the coastal resources and to provide a vehicle for legal authority to implement appropriate programs, among many other directives.

The State of Alaska initiated the Alaska Coastal Management Program (ACMP) in 1974; however, legal authority for the program was delayed until passage of the Alaska Coastal Management Act of 1977 (ACMA) (AS 46.40.010, et seq.). This act provided enabling legislation for the ACMP and the Alaska Coastal Policy Council, which acts to provide policy guidance for the ACMP.

The Coastal Policy Council provides guidelines and standards for development and management in coastal areas. These guidelines and standards are used once again by the council when it reviews district coastal management programs and coastal resource service area programs. The two programs, district coastal management programs, and coastal resource service areas have different guidelines and serve different types of communities in the state. Organized boroughs and first-class cities are directed to prepare district coastal management programs (AS 46.40.030). Unorganized borough's and second-class cities, villages, etc. become part of the coastal resource service areas, usually defined by the boundaries of the Regional Education Attendance Areas (REAA). (AS 46.40.120; 46.40.130.)

It is important to realize that the entire ACMP is a management process, not a way to produce step-by-step geographically-specific plans for land and water use.

2. Energy Facility Siting Process: The Federal Coastal Zone Management Act of 1972, as amended, requires a planning process that identifies potential energy facility locations within coastal resource areas. (Section 305(b)(8), Coastal Zone Management Act, as amended.) The Alaska Coastal Policy Council defines a "major energy facility" as ". . . a development of more than local concern carried out in, or in close proximity to, the coastal area..." (6 AAC 80.900; Alaska Office of Coastal Management and DOC, Office of Coastal Zone Management, 1979). Site selection for energy facilities must be identified by the district and the state working with the districts.

An additional objective for management of coastal areas associated with energy development is the process of identifying and managing uses of state concern within specific areas of the coast. (AS 46.40.040(4).) These issues of major interest due to economic impacts on the state or surrounding area, as defined in AS 46.40.210(6), require actual approval of siting decisions, based on standards for onshore and nearshore energy activity. (6 AAC 80.070(b).) (Alaska Office of Coastal Management and DOC, OCZM, 1979.) Outer continental shelf oil and gas leasing programs are an important source for the state's energy facility siting review process.

3. Aleutian/Pribilof Islands Programs: The Aleutian Islands and Pribilof Islands do not currently have a coastal resource service area or an associated program for coastal zone management review and planning. They are, however, in the process of instituting a coastal zone management program. The following discussion will explain the steps necessary for completion of a coastal management plan and the current status of the Aleutian/Pribilof Islands process.

During February 1981, the State of Alaska, Department of Community and Regional Affairs coordinated public hearings in the Aleutian/Pribilof Islands area regarding the process of organizing coastal resource service areas (CRSA) for the region. It was explained that under policy guidelines set forth in the Alaska Coastal Management Act of 1977, and the ACMP, only first class cities can organize and implement a district coastal management program within the city boundaries. All villages and cities other than first class cities in unorganized boroughs must work within coastal resource service areas (AS 46.40.130; 46.40.140).

Emphasis is now being placed on the Aleutian and Pribilof Islands communities to define the resource service area boundaries. Three possible boundary combinations exist:

--There could be a single coastal resource service area that would include both the Aleutian Islands and the Pribilof Islands.

--There could be two separate coastal resource service areas, one to include only the Pribilof Islands and a second CRSA to include only the Aleutian Islands. These boundaries would then roughly correspond to the two Regional Education Attendance Areas, numbers eight and nine.

--There could be a single coastal resource service area for the Pribilof Islands and there could be two separate coastal resource service areas for the Aleutian Islands, with one CRSA extending northeast of Unimak Pass and the other extending southwest of Unimak Pass. (Personal communication, Veronica Clark, State of Alaska, May 4, 1981.)

In addition to the above mentioned possibilities, the first class cities of King Cove, Sand Point, and Unalaska could decide to organize coastal management programs within their city limits or to work as part of a larger coastal resource service area.

Once several formats have been identified as possibilities for organization, such as the three defined above, the Commissioner of the Department of Community and Regional Affairs makes a decision regarding the organization and size of the coastal resource service area (AS 46.40.120). The Commissioner, as of June 1, 1981, has decided that the Aleutian/Pribilof Islands region will be divided into three coastal resource service areas:

--The Aleutian Islands northeast of Unimak Pass and the southwestern section of the Alaska Peninsula, including the first-class cities of King Cove and Sand Point;

--The Aleutian Islands southwest of Unimak Pass, including the first-class City of Unalaska; and

--The Pribilof Islands

Formal organization of the coastal resource service areas occurs after an election is held in the appropriate geographical region, wherein a majority of the voting community supports the organization of the CRSA (AS 46.40.130). After formal organization and acceptance of the CRSA's there will be a second election to elect a seven-member board that represents the population of the CRSA (AS 46.40.140). This election often has the most interest since personalities from the community start to actively vie for a board seat.

The time frame for the Aleutian and Pribilof Islands area currently indicates that the election of the CRSA acceptance will likely occur in late August 1981, and election of the board members will likely occur by November 1981. (Personal communication, Veronica Clark, May 4, 1981.) After selection of the CRSA boundaries and election of the board, it is estimated that it will be an average of 2 to 3 years before an unincorporated area, such as the Aleutian/Pribilof Islands area, can produce a district coastal management program.

4. Future Environment Without the Proposal: A study by Earl Combs Inc., though somewhat optimistic, estimated that the bottomfish industry in the Aleutian Islands region will be totally controlled by domestic fishermen and processors by the end of the century. Bottomfish industry developments would need to be in agreement with the district coastal management program once it is completed and approved. Direct impacts associated with bottomfishing are analyzed in Section IV.C.6.

H. Other Issues:

1. Water Quality: Discussion of marine water quality in the proposed lease area involves a comparison of reported baseline concentrations against established or putative Federal water quality criteria and State of Alaska water quality standards. Federal water quality management does not require evaluation of marine sediment quality or bioaccumulation of toxic chemicals by marine biota as indicators of water quality. The State of Alaska, however, does have a standard for hydrocarbons in the sediment which reads in part "There shall be no concentration of hydrocarbons in the sediment which causes deleterious effects to aquatic life" (Alaska Dept. of Environmental Conservation, 1979).

A discussion of baseline measurements of heavy metals for the southeastern Bering Sea will include only cadmium, lead, copper, nickel, and chromium. These metals occur in petroleum (crude oil, formation waters, and drilling fluid discharges) at trace levels, and are toxic to at least some marine organisms at such levels. Vanadium, which is an essential nutrient to some organisms at trace levels, is also included because it may be found in petroleum and is frequently used to characterize crude oils. Clark (1976) presents a rationale for the selection of the above trace metals for this discussion.

Table III.H.1.-1 indicates a range of measurements for these metals taken at varying depths throughout the southern Bering Sea. These reported concentrations are between one and two orders of magnitude (10^1 and 10^2) less than the applicable Environmental Protection Agency (EPA) water quality criteria. Burrell (1976) has concluded that the soluble contents for these metals in Bering Sea waters appear to be "as low or lower than other coastal environments," and that this environment is "quite pristine."

Baseline surveys of hydrocarbons in the proposed sale area include the analyses of animal tissues (Shaw, 1978) and the water column for low molecular weight hydrocarbons (Cline et al., 1978). No information is available concerning background levels of alphatic or aromatic components of hydrocarbons from petrogenic input. However, Cline (1978) states that "no sources of petroleum related hydrocarbons were definitively identified," and that "the natural levels of the C_1-C_4 hydrocarbons in the southeastern Bering Sea were relatively low and generally reflect minimal biological input or petroleum pollution."

No baseline data are available in the southeastern Bering Sea for various synthetic organic compounds (i.e. pesticides, herbicides, chemical additives, etc.) which are toxic to biotic communities. Existing concentrations, however, are believed to be low or absent because of the absence of major point and non-point sources.

Table III.H.1.-1
Trace Metal Concentrations (ug/l) From the Southeastern Bering Sea (Burrell, 1976, 1977)

		Surface Concentrations			Subsurface Concentrations		
Metal	Water Quality Criteria[1]	Low Value	High Value	Difference with Criteria[2]	Low Value Depth (m)	High Value Depth (m)	Difference with Criteria[2]
Cd	5	.02	.06	10^{-2}	.02(40)	.12(100)	10^{-1}
Pb	50	.07	.58	10^{-2}	.07(30)	.55(75)	10^{-2}
Cu	45	.2	.75	10^{-2}	.23(145)	.92(100)	10^{-2}
Ni	6-8	.4	.95	10^{-1}	.35(30)	.4(45)	10^{-2}
Cr	100	nd	nd	--	.02(3)	.92(65)	10^{-2}
Zn	1	.06	1.7	10^{-1}	.2(80)	1.5(75)	10^{-1}
V	55,000	1.5	1.3	10^{-4}	1.5(80)	1.0(110)	10^{-4}

---

[1] Water Quality Criteria are from EPA (1976). The criteria for Cd, Pb, and Cr are expressed as numerical limitations by EPA. However, criteria for Cu, Zn, and Ni are expressed as 0.01 of the lowest 96 hour LC 50 test results cited in EPA literature. EPA has no criterion for vandium; a commonly accepted criterion has been derived from literature review of bioassay results discussed in State of California Water Quality Criteria Document (McKee and Wolf, 1963).

[2] "Difference with Criterion" expresses the highest reported concentration of the respective trace metal in order(s) of magnitude less than the applicable water quality criterion.

n.d.: trace metal not detectable by instrumentation.

Existing wastewater discharge sources in the region include municipal wastes seafood processors, commercial fishing vessels, and other ocean going vessels. The stationary sources of discharge are regulated by the EPA under the National Pollution Discharge Elimination System (NPDES), in order to minimize adverse impacts on beneficial uses of receiving waters. The EPA (1977) has reported that seafood processing waste discharges have stressed the marine environment in Dutch Harbor, Iliuliuk Harbor, and Iliuliuk Bay. These discharges have resulted in depressed dissolved oxygen concentrations, increased nutrient concentrations, and accumulation of sludge deposits in these areas. Discharge of sanitary wastes from commercial vessels and petroleum ballast from tankers is regulated by the U.S. Coast Guard.

2. Air Quality: Existing air quality in the proposed sale area is considered pristine. The Environmental Protection Agency (EPA) has prepared emissions inventory and ambient air quality estimates for areas in Alaska with relative low populations, based on general emission factor relationships with local economic base and demographic data. Using this method of air quality analysis, the EPA considers Aleutian Islands election districts, which comprise the onshore portion of the proposed sale area, to be in compliance with Federal ambient air quality standards (EPA, 1978). It is most likely that the area's air quality is far superior to the national and state standards. However, no air monitoring has been performed in the St. George Basin area.

Under provisions of the Prevention of Significant Deterioration Program (PSD), air quality is protected in regions superior to the National Ambient Air Quality Standards. Alaska is designated as either class I or II under the PSD program. Class I air quality designation is most restrictive and applies to national parks, wilderness areas, monuments, primitive areas, wild and scenic rivers, and wildlife refuges that meet certain specifications. There are no class I PSD designated areas in the vicinity of St. George Basin. Hence, the area is designated class II for the PSD program.

3. Land Status and Land Use:

a. Land Status: Land status, or the general land ownership pattern for the Aleutian Islands, lower Alaska Peninsula, and the Pribilof Islands has only recently stabilized to a small degree. Major legislation that has, to date, defined the ownership pattern includes: the Alaska Native Claims Settlement Act (ANCSA) (P.L. 92-203, December 18, 1971, the Federal Land Policy and Management Act of 1976 (FLPMA) (P.L. 94-579, 90 Stat. 2743); the emergency Federal withdrawals under the Antiquities Act (16 U.S.C. 431; 43 FR 57009) in November 1978; the Alaska Statehood Act (P.L. 85-508, 72 Stat. 339 as amended); and the State Enabling Act affecting local governments (A.S. 29.18; A.S. 38.04; CH. 180-182; SLA 1978; CH. 85, SLA 1979). These acts allowed various groups to claim, select, and at some point in time, receive title to various portions of land. In addition to the legislation cited above, the Alaska lands legislation has been decided by Congress and presented as the Alaska National Interest Lands Conservation Act (ANILCA) (P.L. 96-487, December 2, 1980, 94 Stat. 2371).

The following sections describe the current land status in somewhat more detail, though a thoroughly detailed approach is beyond the scope of this document. Detailed status is available from several sources, including the

Bureau of Land Management Master Title Plats, State of Alaska title plats, and village and regional corporation land status maps. Graphic 5. depicts current land status for the geographic region previously defined at a scale of 1:1,500,000.

(1) Federal Lands: With the exception of areas selected by the State of Alaska, or various village and regional corporations, the lands in the lower Alaska Peninsula (from Katmai National Park to False Pass), the Aleutian Islands, and the Pribilof Islands fall within the Alaska Maritime National Wildlife Refuge. This withdrawal is defined under Section 303(1) of the Alaska National Interest Lands Conservation Act of 1980.

(2) Military Withdrawals: Military withdrawals, once extremely wide-ranging in the Aleutian region, are now confined to Nikolski on Umnak Island, Dutch Harbor on Unalaska Island, and Adak on Adak Island. In addition, there is a Naval Defensive Area and Naval Airspace Reserve on Unalaska Island under Executive Order (E.O.) No. 8680 of February 14, 1941. The U.S. Coast Guard has 10 lighthouse areas, all under a 3(e) designation. A 3(e) designation refers to Section 3(e) of ANCSA, which requires a determination as to the smallest practicable tract of land actually used in administration of any Federal installation.

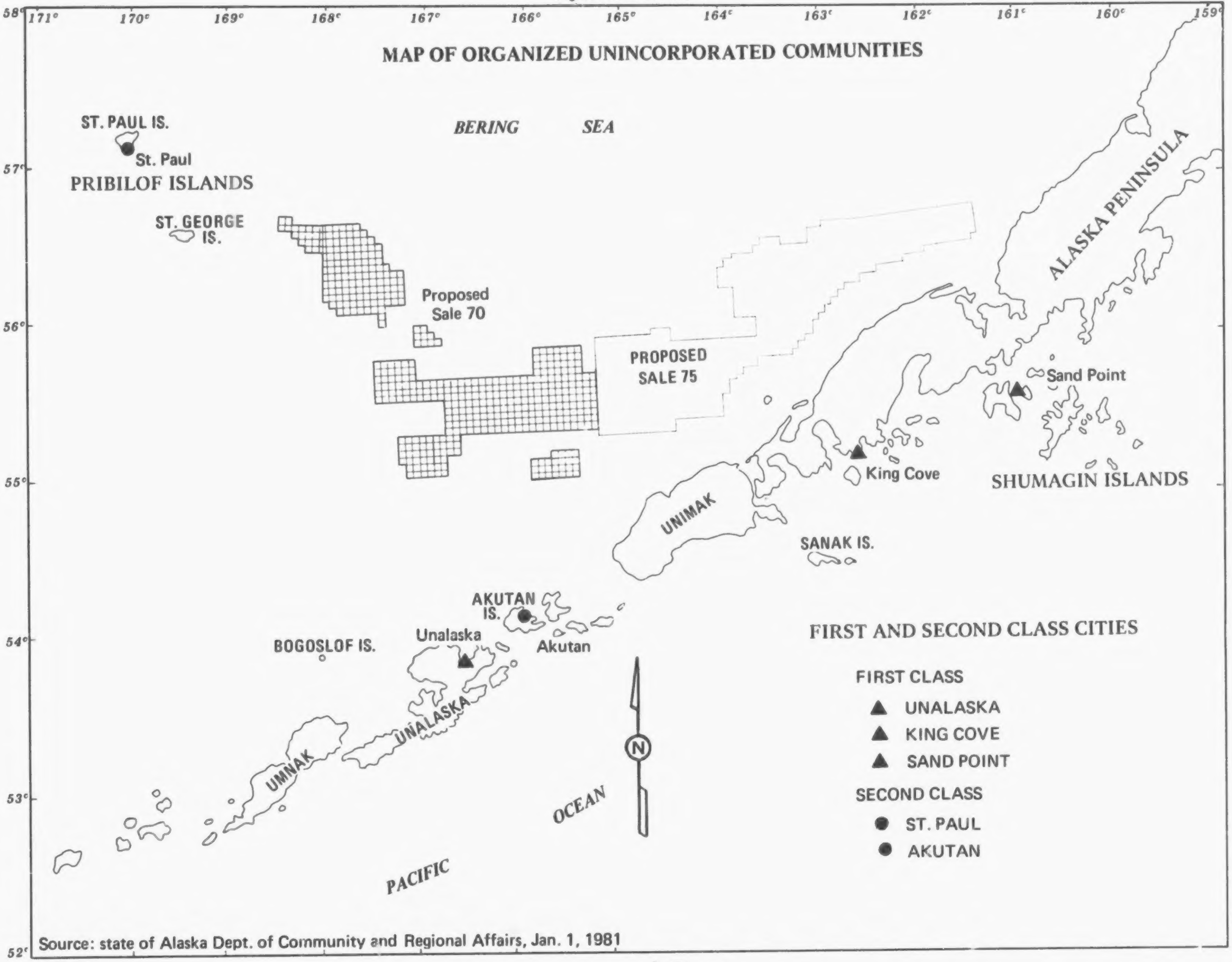
(3) State Lands: The State of Alaska has evidenced interest for only four areas within the Aleutian Islands region. On Akutan Island, the state selected approximately 196 hectares (485 acres); on Uminak Island, they have selected approximately 8,688 hectares (21,468 acres) in one area and another 8,226 hectares (20,326 acres) elsewhere on the island; and on Unalaska Island, they selected approximately 6,275 hectares (15,506 acres). The state has identified a need for those lands, however, the selections are not priority selections. The Bureau of Land Management is working on tentatively approving those lands to the state, however, since it is not a priority area, no action is currently being taken to convey those lands.

In addition to the selected areas, the state has two school sites identified under Executive Order (E.O.) No. 5289 on Akutan Island and E.O. No. 3340 on Umnak Island. The Bureau of Indian Affairs, through a quit claim deed, has given the state approximately 1.25 hectares (3.10 acres) on Umnak Island for school purposes.

(4) Borough, City, and Private Lands: The Aleutian region has only three first class cities (Sand Point, King Cove, and Unalaska) and two second class cities (Akutan and St. Paul). Detail mapping of city and private lands require too small a scale for this document. Figure III. H.3.a.(4).-1 delineates the city areas but does not indicate private or city lands in the appropriate areas. Private land already deeded to individuals include two Trade and Manufacturing Sites on Unalaska, one Trade and Manufacturing Site on Umnak Island and two Soldiers Additional Homesteads on Akutan Island.

(5) Native Corporation Lands: The Alaska Native Claims Settlement Act (ANCSA) has provided for settlement of real property entitlements and financial entitlements for the Native people and Native groups of Alaska. One of the provisions of the Act requires creation of a profit corporation at the regional and village levels to act as enabling institutions to

Figure III. H. 3. a.(4) -1


MAP OF ORGANIZED UNINCORPORATED COMMUNITIES
58°
171°
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ST. PAUL IS.
St. Paul
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ST. GEORGE IS.
BERING SEA
Proposed Sale 70
PROPOSED SALE 75
ALASKA PENINSULA
Sand Point
King Cove
SHUMAGIN ISLANDS
UNIMAK
SANAK IS.
AKUTAN IS.
Akutan
Unalaska
BOGOSLOF IS.
UNALASKA
UMNAK
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OCEAN
PACIFIC
FIRST AND SECOND CLASS CITIES
FIRST CLASS
▲ UNALASKA
▲ KING COVE
▲ SAND POINT
SECOND CLASS
● ST. PAUL
● AKUTAN

Source: state of Alaska Dept. of Community and Regional Affairs, Jan. 1, 1981

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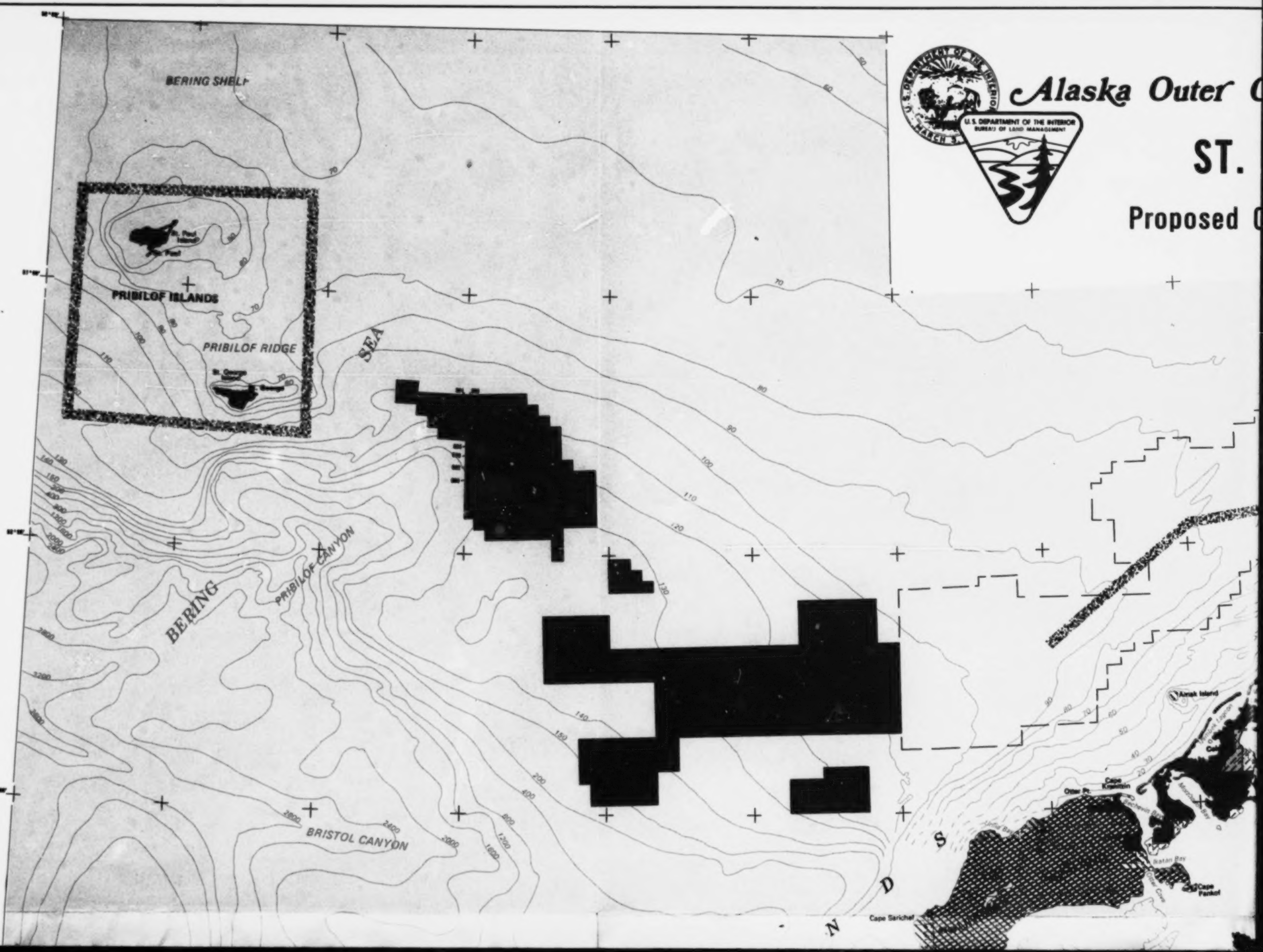

Alaska Outer C

ST.

Proposed C

U.S. DEPARTMENT OF THE INTERIOR
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PRIBILOF ISLANDS
PRIBILOF RIDGE
St. George Island
St. George
SEA
BERING
PRIBILOF CANYON
BRISTOL CANYON
Amak Island
Cape Krenitzin
Otter Pt.
Cape Pankof
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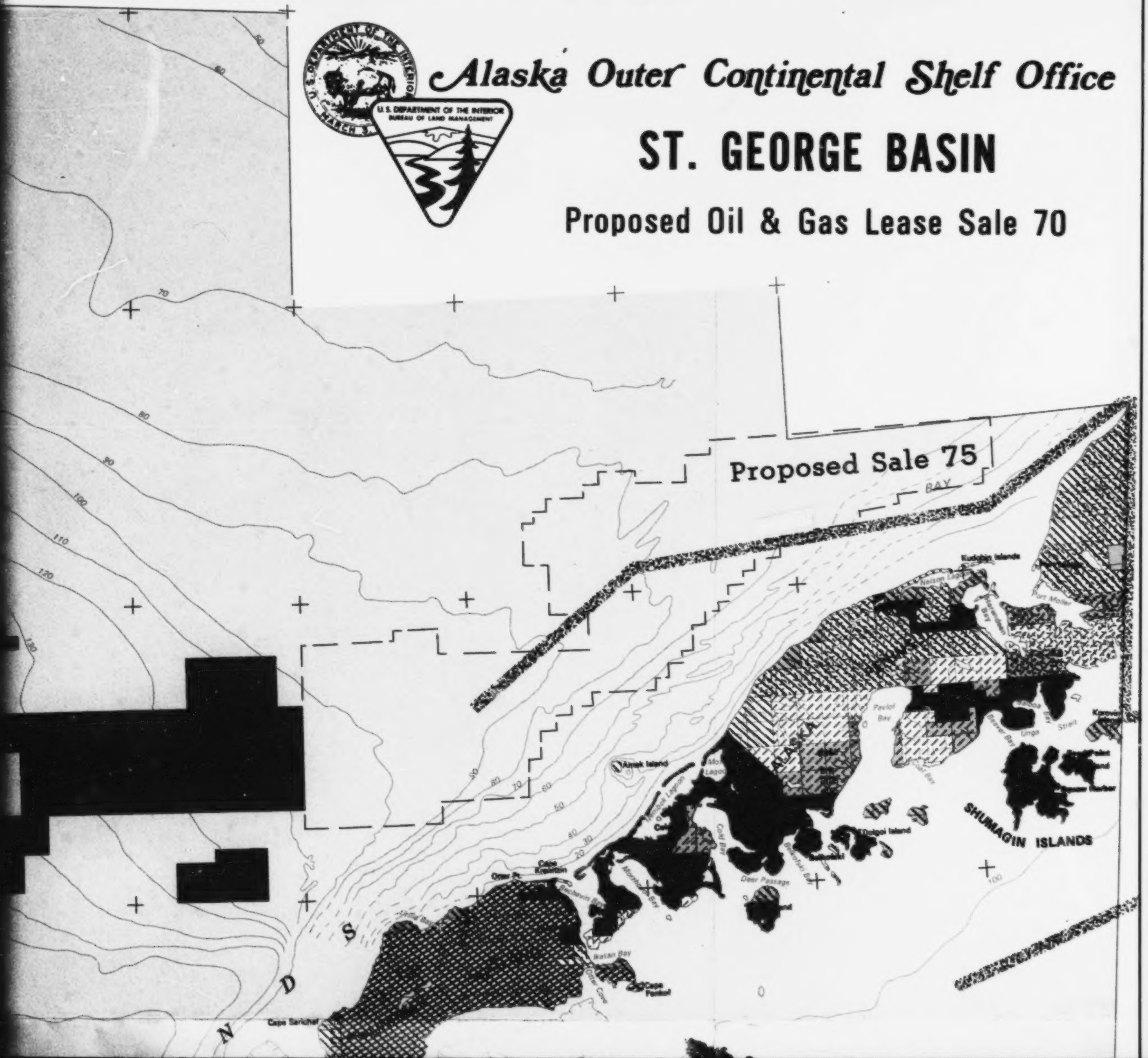
Alaska Outer Continental Shelf Office

ST. GEORGE BASIN

Proposed Oil & Gas Lease Sale 70


Proposed Sale 75
BAY
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Kudobin Islands
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Herendeen Bay
Port Moller
Pavlof Bay
Balboa Bay
Beaver Bay
Unga
Strait
ALASKA
Amak Island
Izembek Lagoon
Cold Bay
Deer Passage
Belkofski Bay
Dolgoi Island
SHUMAGIN ISLANDS
Cape Krenitzin
Otter Pt.
Bechevin Bay
Morzhovoi Bay
Isanotski
Ikatan Bay
Otter Cove
Cape Pankof
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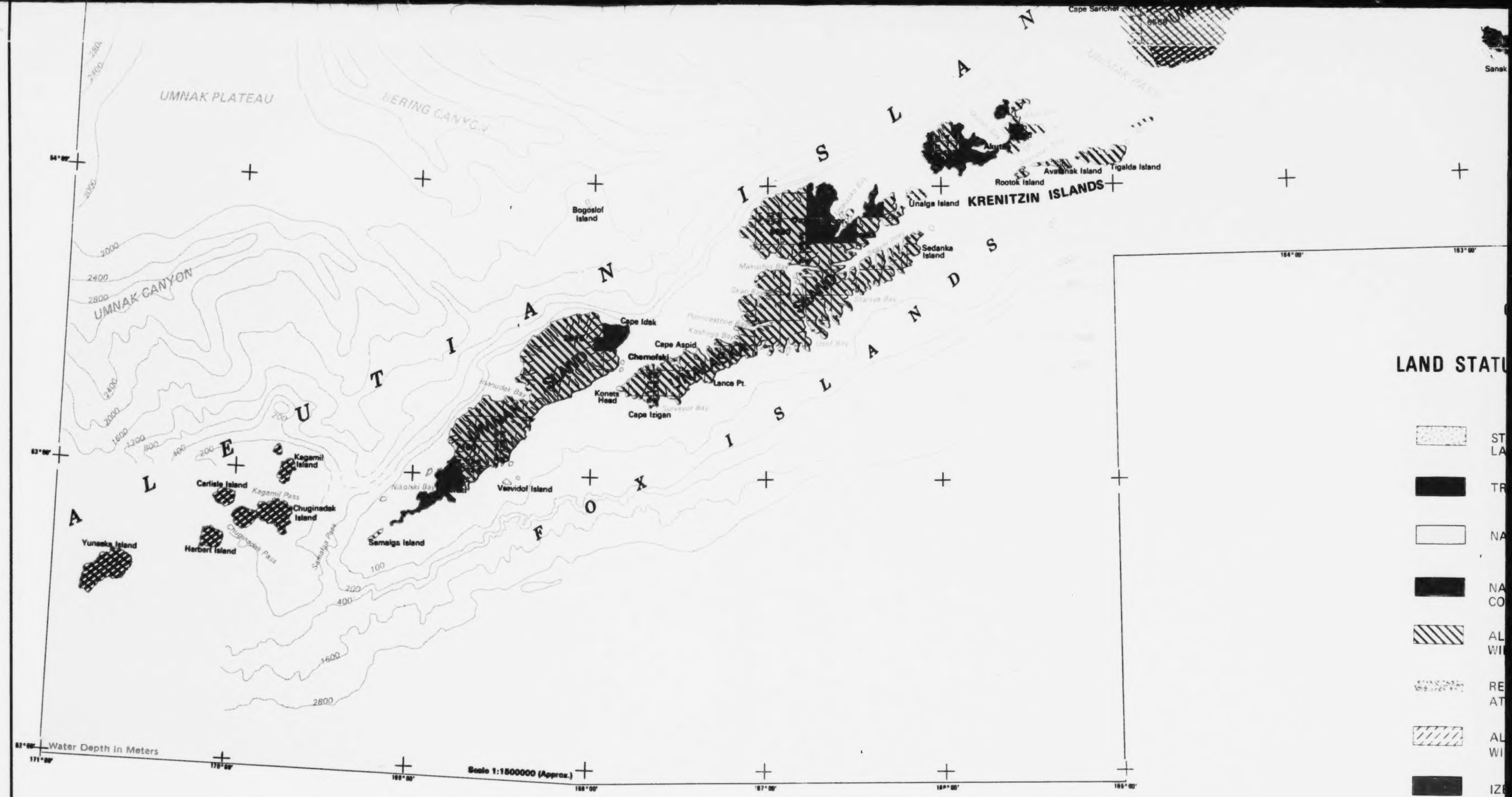
ALEUTIAN ISLANDS
FOX ISLANDS
KRENITZIN ISLANDS
UMNAK PLATEAU
BERING CANYON
UMNAK CANYON
UNIMAK PASS
Cape Sarichef
Sanak
Akutan
Avatanak Island
Tigalda Island
Rootok Island
Unalga Island
Sedanka Island
Bogoslof Island
Cape Idak
Cape Aspid
Chernofski
Lance Pt.
Konets Head
Cape Izigan
Surveyor Bay
Makushin Bay
Skan Bay
Pumicestone Bay
Kashega Bay
Beaver Inlet
Inanudak Bay
Nikolski Bay
Vsevidof Island
Samalga Island
Kagamil Island
Carlisle Island
Kagamil Pass
Chuginadak Island
Chuginadak Pass
Samalga Pass
Herbert Island
Yunaska Island
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169°00'
168°00'
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SOURCE: Alaska Dept. of Community and Regional Affairs. Jan. 1981. Municipalities, Boroughs and Cummunities Map.
U.S. Dept. of the Interior, Bureau of Land Management, Alaska Native Claims Settlemanment Act, Div. of Operations.Unpublished. Native Land Selections and Interim Conveyance Mapping within Aleut Regional Corp.
U.S. Dept. of the Interior, Bureau of Land Management. Dec.1981. Alaska National Interest Lands Conservation Act Map. P'L. 96-487.

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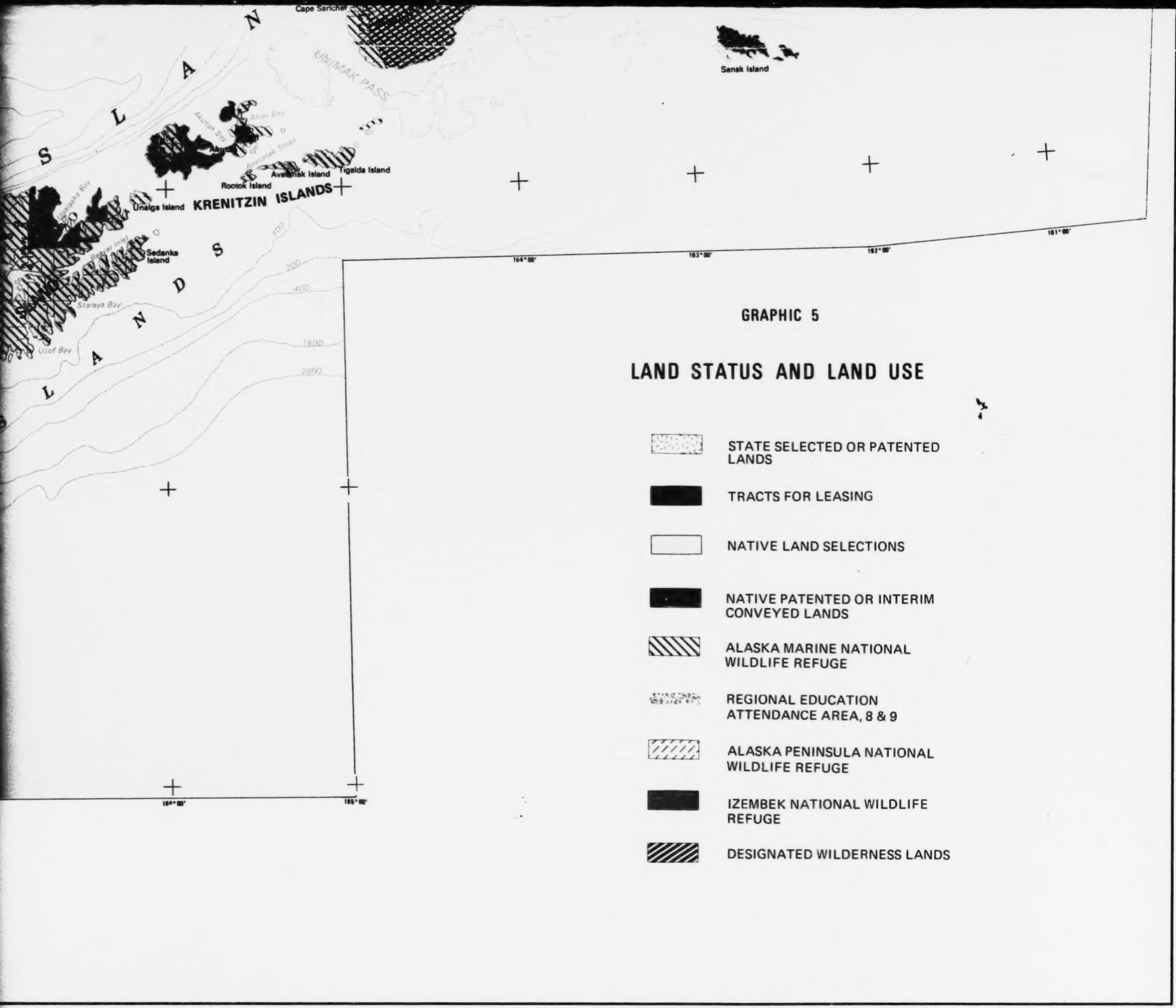

Cape Sarichef
UNIMAK PASS
Sanak Island
Akun Bay
Akutan Bay
Akutan
Avatanak Strait
Rootok Island
Avatanak Island
Tigalda Island
Unalga Island
KRENITZIN ISLANDS
Unalaska Bay
Beaver Inlet
Sedanka Island
Staraya Bay
Usof Bay
100
200
400
1600
2800
164°00'
163°00'
162°00'
161°00'
STATE SELECTED OR PATENTED LANDS
TRACTS FOR LEASING
NATIVE LAND SELECTIONS
NATIVE PATENTED OR INTERIM CONVEYED LANDS
ALASKA MARINE NATIONAL WILDLIFE REFUGE
REGIONAL EDUCATION ATTENDANCE AREA, 8 & 9
ALASKA PENINSULA NATIONAL WILDLIFE REFUGE
IZEMBEK NATIONAL WILDLIFE REFUGE
DESIGNATED WILDERNESS LANDS

GRAPHIC 5

LAND STATUS AND LAND USE

198-A

BEST DOCUMENT AVAILABLE

receive the associated land entitlements. There are three regional corporations within the area potentially affected by the proposed lease sale area: the Aleut Corporation, the Bristol Bay Native Corporation, and Koniag, Incorporated. The Aleut Corporation would be the corporation most directly affected by the proposed sale.

Villages and their associated village corporations within the proposed sale area include:

Nelson Lagoon - Nelson Lagoon Corporation

Belkofski - Belkofski Corporation

King Cove - King Cove Corporation

False Pass - False Pass Corporation

Akutan - Akutan Corporation

Unalaska - Ounalaska Corporation

Nikolski - Chaluka Corporation

St. George - Tanaq Corporation

St. Paul - Tanadqusix Corporation

Sand Point - Shumagin Corporation

Table III.H.3.a.(5)-1 lists the villages with information on acreages of land selected, interim conveyed, and patented to the appropriate corporation.

b. Existing Land Use: Within the Aleutian Island and Pribilof Island areas, there is a relatively small amount of developed land. Aside from lands within the village and urban areas of the first and second class cities, land development is generally not occurring. Land use away from village areas is primarily limited to occasional recreational use, including sport fishing, some subsistence use, and seasonal residences. Commercial fishing is very important and occupies much of the land near the villages. The Aleutian and Pribilof Islands areas are primarily undeveloped and are most likely to remain that way due to harsh weather conditions and high transportation costs.

(1) Federal: As identified earlier, most of the Aleutian Islands are within the Alaska Maritime National Wildlife Refuge, which precludes development. Management is basically under the Department of the Interior, U.S. Fish and Wildlife Service. Interim management for lands held under trust or until patent is given to the Native corporations or Native individuals is under the jurisdiction of the Bureau of Land Management (BLM). BLM management is mainly limited to scattered parcels of land along the northern side of the Alaska Peninsula. No special management techniques or development plans are under consideration for the immediate future.

Table III.H.3.a.(5).-1
Village Acres Selected, Patented
Aleutian Region

(1) Village	(2) Land Entitlement	(3) Original Village Selection	(4) Village Overselection	(5) Land Selection Outstanding (a)	(6) Lands Under Interim Conveyance	(7) Patented Lands
Akutan	92,160	94,892	2,732	2,387.06	89,772	.94
Belkofski	69,120	73,360	4,240	2,259	66,861	----
False Pass	69,120	74,699	5,579	1,770	67,350	----
King Cove	115,200	121,380	6,180	6,084	109,116	----
Nelson Lagoon	69,120	75,072	5,952	5,658	63,462	----
Nikolski	69,120	70,753	1,633	5,982	63,138	----
St. George	115,200	124,825	9,625	8,893.79	106,306	2.10
St. Paul	138,240	162,965	24,725	38,675.72	99,102	462.28
Sand Point	138,240	139,158	958	7,874.94	130,365.06	----
Unalaska	115,200	126,493	11,293	4,794.11	110,269.5	136.39
Aleut Corp.	1,152,000			29,067.69	1,122,330.56	601.75

(a) Amount selected but not disposed of yet.

Source: BLM Easement Management Report dated April 3, 1981

(2) State: The State of Alaska currently has ownership of some isolated parcels, mainly for school purposes and mineral leasing. The state has selected a few parcels, primarily on Umnak Island and the Alaska Peninsula; however, these selections are not a high priority for state ownership.

(3) Private: The impetus for private development in the Aleutian and Pribilof Islands area could come from four sources: the regional Native corporation, the Aleut Corporation; individual Native village corporations; private individuals, singly or in small groups; and private industry, such as the commercial fishing industry or the oil and gas industry. Generally speaking, the majority of available land (that is, land not already developed and without environmental hazards making development unfeasible) is held by individual Native corporations. There is not a large amount of land available that is not already developed or that does not have severe environmental constraints associated with it.

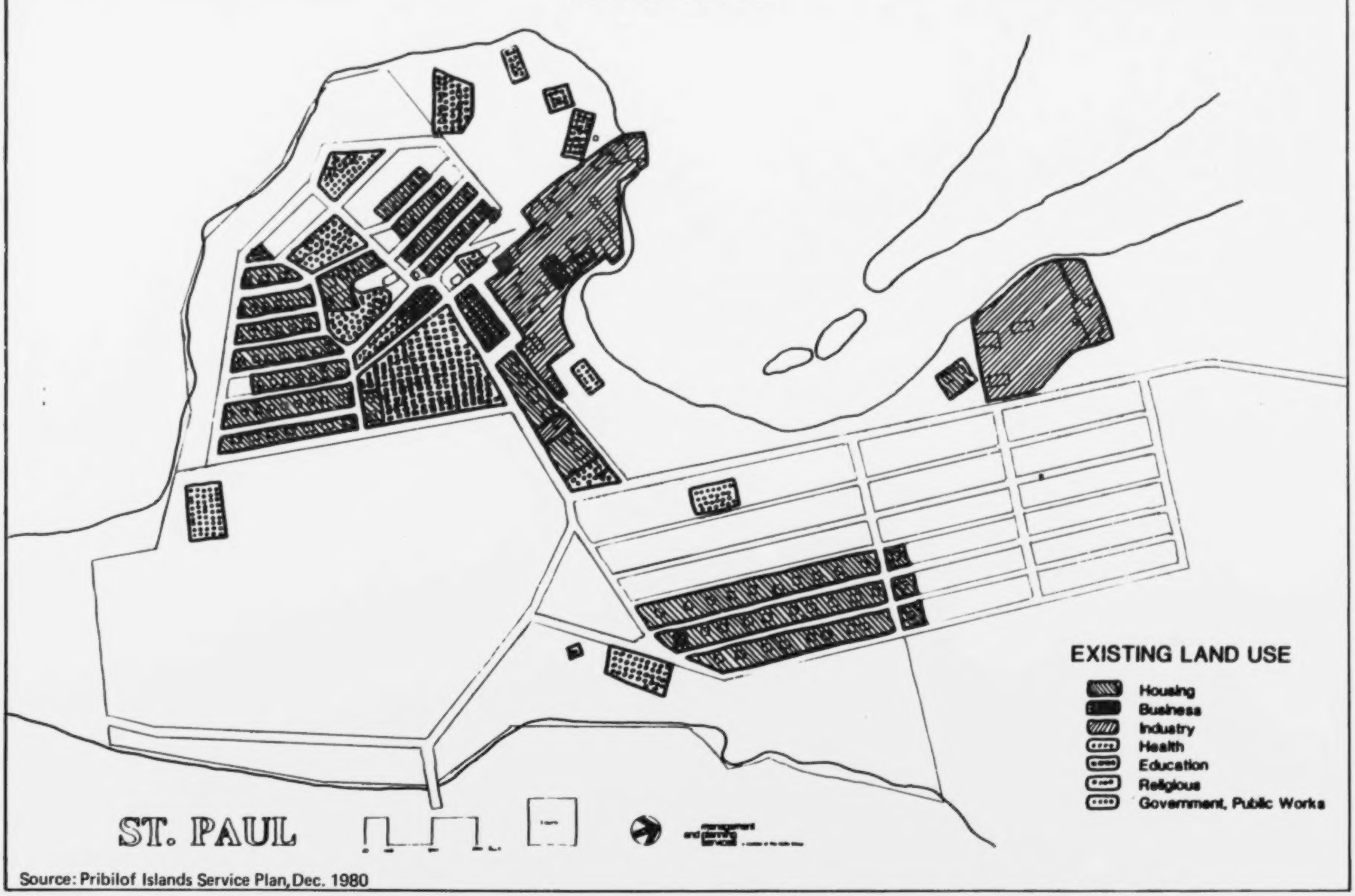
St. Paul, developed as a company town under control of the National Marine Fisheries Service and Government Island Management, is amazingly orderly in its development. Figure III.H.3.b.(3).-1 shows the general layout of St. Paul. Industrial uses are concentrated around the waterfront, with commercial development and major public facilities layered in behind the industrial uses. Residential use is mainly confined to areas behind the commercial and public facility areas. A final report has been issued by Management and Planning Services, December 1980, entitled the Pribilof Islands Service Plan, which outlines possible combinations of city government managing certain city functions, or combinations of city and Federal government management. Members of the Tanadgusix Corporation have indicated considerable interest in diversifying the economic base of the island to include a commercial day-fishing industry and an associated development of a small boat harbor.

Development in the Unalaska/Dutch Harbor area is somewhat limited, as there is not a great deal of developable land available. Recent development of the Unisea Mall and Inn complex in Dutch Harbor brought new commercial development to the area. Unalaska's comprehensive development plan was completed in 1977 by the firm of Tryck, Nyman and Hayes. Most of the land area in Unalaska/Dutch Harbor which was formerly under Federal government ownership has been conveyed to the Ounalaska Corporation. Their preference is to lease the land to potential users as opposed to selling it outright. Figure III.H.3.b.(3).-2 shows the general existing land use as of 1977.

In 1977, there were approximately 607 hectares (1,500 acres) of suitable undeveloped land in the Unalaska area (Tryck, Nyman and Hayes, 1977). Residential areas include the undeveloped lots in Unalaska townsite, Unalaska Creek, and Pyramid Creek valleys. On Amaknak Island, residential areas lie west of Margaret Bay adjacent to Unalaska Bay, the Standard Oil Hill, and the area north of the airport. Commercial development areas include vacant areas in the Unalaska townsite, along Unalaska Creek road between Unalaska Lake and the public works maintenance facility, and the west end of Margaret Bay, on the uplands area behind the Standard Oil dock and near the airport (Alaska Consultants, Socioeconomic Systems Impact Analysis, February 1981).

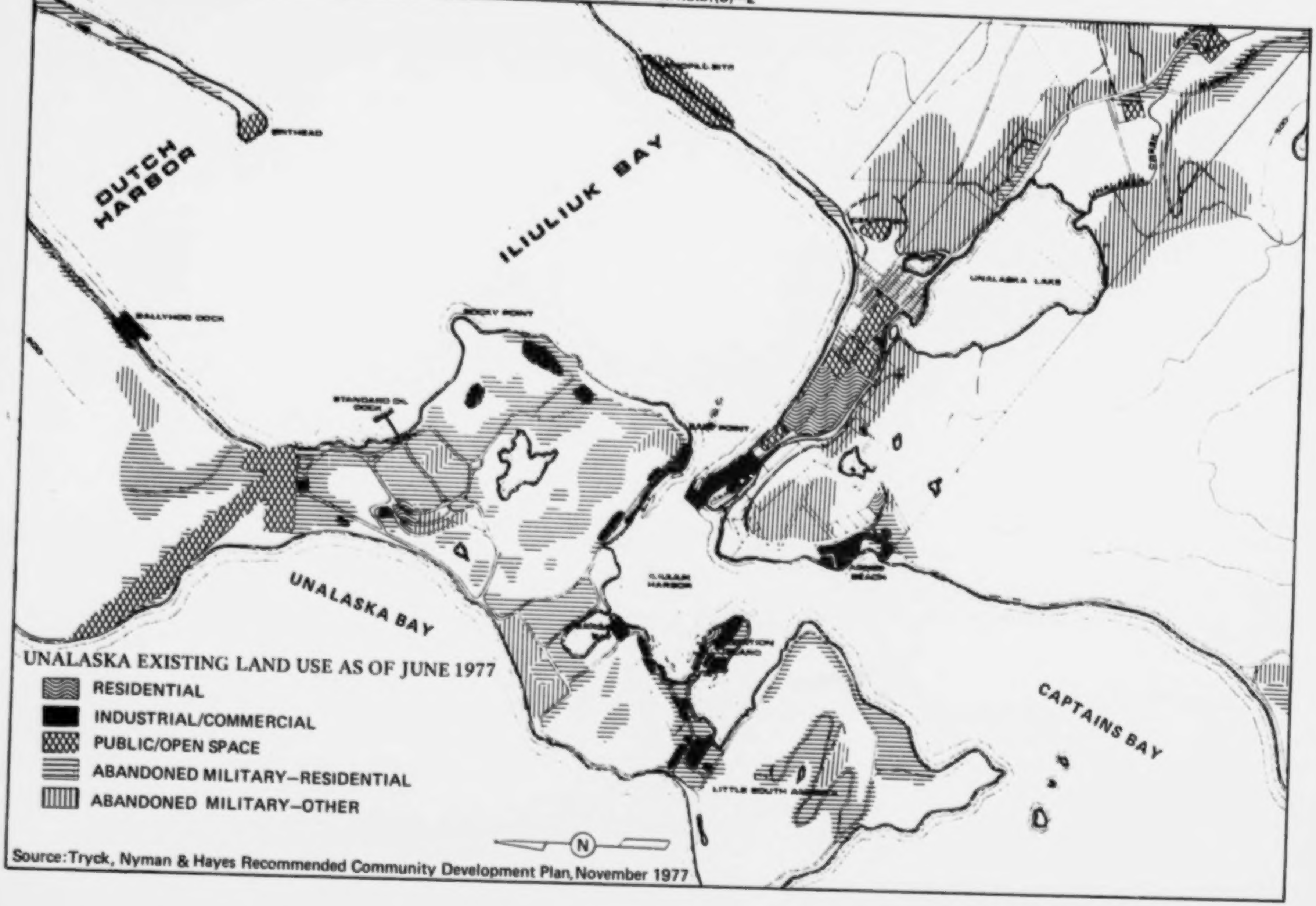
Figure III. H. 3. b.(3) -1

ST. PAUL LAND USE


EXISTING LAND USE
Housing
Business
Industry
Health
Education
Religious
Government, Public Works
ST. PAUL

Source: Pribilof Islands Service Plan, Dec. 1980

Figure III.H.3.b.(3)–2


DUTCH HARBOR
SPITHEAD
ILIULIUK BAY
BALLYHOO DOCK
ROCKY POINT
STANDARD OIL DOCK
UNALASKA LAKE
UNALASKA BAY
CAPTAINS BAY
LITTLE SOUTH AMERICA
N

UNALASKA EXISTING LAND USE AS OF JUNE 1977

- ▨ RESIDENTIAL
- ■ INDUSTRIAL/COMMERCIAL
- ▩ PUBLIC/OPEN SPACE
- ▤ ABANDONED MILITARY–RESIDENTIAL
- ▥ ABANDONED MILITARY–OTHER

Source: Tryck, Nyman & Hayes Recommended Community Development Plan, November 1977

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BEST DOCUMENT AVAILABLE

Waterfront industrial areas suggested by the 1977 comprehensive plan include lands around Margaret Bay and Rocky Point Flats, and an area on the west channel side of Little South America. Additional lands that could withstand expansion include Agnes Beach area, land adjacent to the Pyramid Creek and Captain's Bay road junction, and the area near the Pacific Pearl cannery at the Captain's Bay dock (Alaska Consultants, February 1981).

There is very little land available at Cold Bay for development, primarily because Cold Bay is unincorporated and is occupied mainly by government agencies, which do specific planning only for the site which they occupy.

The only other village which could experience some change or growth in its existing land use area is False Pass. In spring of 1981, the cannery at False Pass burned down. It is uncertain at this time whether or not the cannery will be rebuilt onshore, in the same place, moved and expanded onshore, or be replaced by an offshore facility.

c. Future Environment Without the Proposal: A study by Earl Combs Inc. (1981) estimated that the bottomfish industry in the Aleutian Islands region will be totally controlled by domestic fishermen and processors by the end of the century. Forecasts of future and local employment are for tremendous increases in resident employment and increases in the transient labor force for the Aleutian Islands. Land needed for housing, shore-based processing plants, and waterfront areas for fishing boat docks could pose additional land management problems in areas already without significant acreages of available developable land. Direct impacts associated with bottomfishing are analyzed in Section IV.H.3.b.

4. Visual, Wilderness, and Recreational Resources: The proposed sale area, Alaska Peninsula, Aleutian Islands, and Pribilof Islands have abundant recreational, wilderness, and visual resources. These resources are unique compared to other areas of Alaska. For example, the Alaska Peninsula and the Aleutian Chain coastlines contain more volcanoes per linear mile than most coastlines in the world. The Aleutian Chain has fewer trees per thousand miles than any area of the United States which is bounded on two sides by the ocean. It has the smallest spruce forest of any major region in the United States.

The Pribilof Islands, though isolated geographically, hosts many visitors, mainly during the summer. Nearly 1,000 tourists come to St. Paul Island in the summer (see Johnson, Froehlich and McKittnick, 1978). Many travel in special groups, such as the National Audubon Society, and many come with special tour companies through the auspices of the local Tanadgusix Corporation from places as far away as Seattle, Chicago, New York, and Paris. The tourist load is great enough that many summers, Reeve Aleutian Airways and smaller carriers, such as Peninsula Airways, increase their weekly service to the Pribilof Islands to three times per week. These flights feature sightseeing tours of volcanoes on the Aleutian Islands. Most flights allow tourists to stop at Cold Bay where, at certain times of the year, large herds of caribou may be seen and hunted within about 80 to 160 kilometers (50-100 mi) north of the city. The Aleutian Islands, as well as the Alaska Peninsula, display many remnants of the World War II era, e.g., old quonset huts near Cold Bay, pill boxes, submarine repair buildings, and barracks. Dutch Harbor may be seen along the route to the Pribilof Islands.

On St. Paul Island, visitors travel by bus to the fur seal rookeries, where they may watch and photograph from a blind the harvesting of fur seals. This is the only harvest of fur seals in the United States. The bus tour also includes a trip to the bird rookeries which contain the largest seabird nesting colonies in the northern hemisphere. On St. Paul Island alone, about 250,000 birds nest on the cliffs. One-hundred ninety-one species of birds can be seen on the island.

According to paleographers, the cliffs on St. Paul Island were at the edge of the shoreline of Alaska 22,000 years before the present and, no doubt, at that time had some of the largest nesting colonies of birds; they were also the hauling out places for seals.

The Izembek Lagoon on the Alaska Peninsula, is the exclusive summer habitat of the black brant. Many people observe and photograph these birds in their natural habitat.

The Aleutian Islands, Alaska Peninsula, and the Pribilof Islands have numerous archaeological sites and historic churches which may be visited. For details, see OCS Technical Paper No. 2 (Tornfelt, 1981).

Almost all of the cities and villages near the proposed sale area are sport fishing places for local residents as well as for visitors. Many scenic rivers in the area may be floated.

Bogoslof Island is a visual historic geological feature near the proposed sale area. At least six island masses rose there over the past 130 years. Remnants of the last three eruptions form the present island. The approximately 5,000 Stellar sea lions, together with over 50,000 seabirds (puffins and murres) on the 65 hectare (160 acre) island present a unique spectacle. The colonizing plant communities that occupy a narrow band just above high tide line are of extreme value in botanical succession studies.

Shishaidin Volcano is an outstanding visual resource. The crater of this volcano is the tallest of the 11 known volcanos on Unimak Island which is about 80 kilometers (50 mi) west of Cold Bay. The actual cone and crater encompass about 25,500 hectares (63,000 acres). It is part of the Aleutian Islands National Wildlife Refuge. Eruptions have been recorded from the volcano since 1775. Major explosive eruptions occurred in 1824 and 1830. The volcano continues to be active. The scenic aspects of this tall, sym-metrical volcano are magnificent. It has been used as a guiding object for centuries (see Taylor, 1967). Probably the mountain's great significance is simply "that it is there" like Hillary's Everest. Taylor (1967) quotes Robert F. Griggs, "Shishaldin is one of the most perfect cones in the world." He compares its beautiful white symmetry "a formidible rival to the celebrated Fujiyama."

Locations of the visual, recreational, and wilderness resources mentioned above are shown on Graphic 4.

5. Terrestrial Mammals: Two large game mammal species, brown bear, (*Ursus arctos*) and barren ground caribou (*Rangifer tarandus granti*) occupy the Alaska Peninsula and Unimak Island.

Brown bears are found along most stream drainages and in other coastal plain habitats from May to October; during the remainder of the year they occupy denning areas in the adjacent Aleutian Range from Cold Bay to Port Moller and northeast along the Alaska Peninsula. Intensive use areas include north-central Unimak Island, the Cold Bay area, and the Peninsula northeast of Izembek Lagoon (ADF&G, 1973). Bears forage intensively along beaches in spring and fall. An estimated 2,000 to 3,000 bears occupy the Alaska Peninsula. At Izembek National Wildlife Refuge, counts made from 1977 through 1979 range from 78 to 115 (Dauenhauer, 1980).

Caribou are present in foothills and coastal plain habitats over most of the Alaska Peninsula and Unimak Island. Caribou winter on lowlands northeast of Izembek Lagoon and Cold Bay to Herendeen Bay (ADF&G, 1973). Calving occurs from mid-May to mid-June from northeast of Izembek Lagoon to north of Pavlof Bay. An estimated 6,000 to 8,000 animals range from Port Moller to Cold Bay, and 1,500 occupy Unimak Island (Hemming, 1971). Izembek refuge personnel counted 5,844 caribou on a November 1979 census. Migratory habits of the peninsula herd are erratic; the herds drift southwest in spring (February-May) and northeast in fall (late August-December).

I. BLM Studies Programs

1. Environmental Studies Program: In each OCS area proposed for gas and/or oil development, extensive environmental studies are conducted before such development is allowed. As manager of the Outer Continental Shelf Leasing Program, the Bureau of Land Management (BLM) of the Department of the Interior (DOI) initiated the Outer Continental Shelf Environmental Assessment Program (OCSEAP) as an essential part of its management responsibility. The environmental studies program is conducted under interagency agreement between BLM and OCSEAP of the National Oceanic and Atmospheric Administration (NOAA), Department of Commerce (DOC).

In 1974, BLM requested that NOAA initiate an environmental assessment program on the outer continental shelf. A studies program for proposed lease areas and some non-specific study areas in Alaska was planned. This program assembled historical data about the Alaska Outer Continental Shelf and addressed new study needs to provide a basis for assessment of petroleum exploration and development impacts.

Study efforts in the St. George Basin area began in 1975. The initial studies were broad-scale surveys and produced information defining circulation patterns, sea floor faults, seismic activity, unstable sediment areas, critical habitats, and biological populations. Special studies were intensified in subsequent years to fill data gaps in nearshore processes and to determine possible environmental impacts due to OCS development.

The specific objectives of the Alaska OCS Environmental Assessment Program are described below:

a. Contaminant Distribution: These studies are intended to establish predevelopment hydrocarbon and trace metal concentrations along carefully designed station grids.

A significant part of the contaminant distribution study program was directed towards process orientated studies. These studies were designed to give insight into processes that control hydrocarbon distributions in the Alaska OCS and to answer questions of seasonal variability of pollutant concentrations in water, biota, and sediments due to biological activity or petroleum exposure.

b. Geologic Hazards: Geologic hazards to petroleum-related activities in the St. George Basin center around seismicity. Other hazards are posed by surface and near-surface faulting, sediment instability, erosion and deposition, and stratigraphy.

Many hazards present in Alaska lease areas also occur in other U.S. shelf areas. However, in Alaska, these problems are unique in terms of severity and complexity. A knowledge of the nature, frequency, and intensity of severe environmental events is essential.

Seismic field studies began in fiscal year 1975 to supplement existing studies being funded by other agencies. For 6 years the BLM directly supported part of the seismic program in an ongoing Geological Survey study, employing a land-based network of seismographic stations. All geohazard studies conducted by the University of Alaska have been funded through BLM/OCSEAP. The major objectives of these seismic studies are to determine a probability scale for earthquake hazards and to improve the statistical reliability of the existing data base. This has been accomplished through continuation of present observational programs and use of additional or improved instrumentation, such as ocean-bottom seismometers and strong motion accelerometers.

Shelf faulting and sedimentation studies are conducted in order to define potential hazards so that environmental risks can be minimized by avoidance or by appropriate regulation of facility siting, design, and construction. Certain geologic features, identified as potentially troublesome during regional reconnaissance of the proposed lease area, are studied in further detail. The regional reconnaissance phase requires about a 2-year study effort. Focused studies on special problems take an additional 2 to 3 years. These are time estimates which vary depending upon the proposed lease area size, geological complexity, and nature of the identified hazards.

The studies on shelf faulting and sedimentation have produced basic information on geologic hazards of the area, including location of probable active faults, potentially unstable sediments, and erosional and depositional areas on the shelf. The work is being continued to gather additional block-specific hazards information.

c. Pollutant Transport: Transport and transformation (weathering) of petroleum-related contaminants are significant considerations in an assessment of potential impacts of OCS developments. Petroleum and other contaminants introduced into the environment can be transported in the atmosphere, in the water column, and by sea ice. During transport, contaminants undergo continual physiochemical changes, such as evaporation, flocculation, emulsification, weathering, biodegradation, and decomposition.

Transport studies are designed to provide information that will enable the Department of the Interior and other agencies to (1) plan stages and siting of offshore petroleum development to minimize potential risks to sensitive environments; (2) provide oilspill trajectories, coastal landfall, and effects of oilspill cleanup operations; and (3) assist in planning the location of long-term environmental monitoring sites in the study area.

Long-term, direct measurements of coastal winds and currents in the St. George Basin area have been performed by OCSEAP. Transport studies were designed to proceed from a regional description of oceanographic and meteorological features to analyses of processes. Oceanographic investigations included literature summaries, current measurements, hydrographic station data, remote data sensing, and computer modeling. Meteorologic studies have concentrated on field observations and computer simulation of coastal wind patterns.

The oceanographic studies lead in part to an oilspill trajectory model, which is the basis of the Oilspill Risk Analysis that is described in Section IV.A.4. The oilspill trajectory model that has been prepared for the St. George Basin area is an excellent, sophisticated model.

d. Biological Resources: A major reason for conducting biological population studies in the St. George Basin area has been to determine which populations, communities, and ecosystems are at risk from oilspills or increased industrial activity in the area. Distribution and abundance estimates, migration patterns, feeding sites, and population behavior are the first studies undertaken. The study results are used to determine potential vulnerability. Should vulnerability be indicated, detailed site specific studies are undertaken. These studies focus on ecosystem processes, trophic and population dynamics, disturbance sensitivity, habitat dependence, and physiological characteristics.

The first few years of biological studies were concerned with the distribution and abundance of key species through reconnaissance surveys. For higher trophic levels, these studies identify critical habitats, migratory routes, and principal seabird and marine mammal breeding locations.

e. Effects: Effects research is ongoing; it is not designed exclusively for any one proposed lease sale area. The research results are used to establish possible long-term causal relationships between OCS-related perturbations and biological changes, and to form the basis for developing discharge regulations and operating stipulations. Also, the studies program is evaluating biological responses to stresses in order to determine their potential usefulness as early warning indicators or monitoring aids in detecting and/or quantifying environmental changes.

Prior to 1979, most effects studies were conducted in the laboratory. However, in fiscal years 1979 and 1980, the emphasis shifted toward field studies. The field studies are designed to validate laboratory observations and to obtain data on exposure concentrations and compositions likely to occur under various environmental conditions.

All of these studies have culminated in two meetings. One symposium was held in Anchorage on November 1979. The meeting was designed to synthesize all available information on the southeastern Bering Sea. The proceedings of this symposium are published in a two-volume report called: The Eastern Bering Sea Shelf: Oceanography and Resources. This report is now available at: OCSEAP Alaska Office, P.O. Box 1808, Juneau, Alaska 99802. A second symposium or synthesis meeting was held in Anchorage in April 1981 to initially assess, with the whole environmental data base, the proposed OCS lease sale in the St. George Basin. Reports on this meeting will be available from the above OCSEAP Alaska Office in fall 1981.

A bibliography of the OCSEAP Environmental Studies on the St. George Basin area is listed in Appendix I. Aside from the environmental information that has been collected by OCSEAP, much information on endangered whales has been collected directly by the Alaska OCS Office as part of the BLM Environmental Studies Program. The whale studies that are relevant to assessment of potential impacts of oil and gas leasing in the St. George Basin are listed below according to the year in which they were funded.

Fiscal Year - 1979

1. Tissue Analysis.

2. Baleen Fouling.

Fiscal Year - 1980

1. Collection and Analysis of NMFS Marine Mammal Platforms of Opportunity Program Data

2. Monitoring the Movements of Whales in and Adjacent to OCS Lease Areas (Tagging).

3. Effects of Whale Monitoring System Attachment Devices on Whale Tissue

4. Development of Large Cetacean Tagging Capability in OCS Lease Areas

Fiscal Year - 1981

1. Tissue Analysis of Endangered Whales in the Beaufort Sea.

2. Baleen Fouling.

3. Possible Effects of Acoustic and Visual Stimuli Associated with Oil and Gas Exploration and Development on the Behavior of the Bowhead Whale.

Fiscal Year - 1982

1. Aerial Surveys of Endangered Whales in the Southern Bering Sea and Northern Gulf of Alaska Regions.

2. Endangered Whale Surveys in the Navarin Basin.

3. Cumulative Effects of Noise Disturbance on Gray Whale Migratory Behavior.

4. Gray Whale Feeding Ecology--Amplescid Amphipod Study, Chirickov Basin.

The reader should refer also to the U.S. Dept. of the Interior 1980. Proceedings of the Interagency Meeting to Review, Coordinate, and Plan Bowhead Whale Research, Other Cetacean Research, and Related Research Bearing Upon the Conservation and Protection of Endangered Marine Species in Alaska and Elsewhere. Washington, D.C.: U.S. Dept of the Interior, Bureau of Land Management.

2. Socioeconomic Studies Program: The Socioeconomic Studies Program (SESP) of the Alaska OCS Office was created to determine and assess the potential onshore social, economic, and physical impacts from outer continental shelf oil and gas development. As a multi-year, multi-discipline program, the SESP conducts studies on the sociological and anthropological aspects of diverse groups. The SESP focuses on a longitudinal investigation of the development process, beginning from the assembly of predevelopment information to the monitoring of project development as it affects specific communities, regions, or the state as a whole. In addition, the program makes economic analyses of rural and urban communities, regions within the state, and the state as a whole, with assessments of both natural and manmade infrastructures.

The overall methodology is divided into three broad research components. The first component identifies an alternative set of assumptions regarding the location, nature, and timing of future petroleum events and related activities. In this component, the program takes into account the particular needs of the petroleum industry and projects the human, material, economic, and environmental offshore and onshore development requirements of the regional petroleum industry.

The second component focuses on data gathering that identifies those quantifiable and qualifiable facts by which OCS-induced changes can be assessed. The critical community and regional components are identified and evaluated. Current sources of change and functional organization among different sectors of community and regional life are analyzed. Susceptible community relationships, values, activities, and processes are also included.

The statewide/regional analysis focuses on the statewide effects of cumulative and incremental lease sales, and the distribution of these effects among certain defined subregions of the state. The local level analysis focuses on the direct effects of a lease sale on affected communities.

The SESP identified the study areas for the proposed St. George petroleum development region to include the census divisions of Anchorage, Seward, Kenai-Cook Inlet, Matanuska-Susitna, Vadez-Chitina-Whittier, Cordova-McCarth, Kodiak, Bristol Bay, Bristol Bay Borough, Bethel, Wade Hampton, Kuskokwim, and the Aleutian Islands. The following major study tasks were conducted:

a. Petroleum Technology Assessment: Potential arctic petroleum technologies associated with the proposed lease sale in the St. George Basin were assessed. The study identified and evaluated the probable technologies associated with OCS development in the proposed lease sale area, analyzed the economic characteristics (unit costs, timing, and man-power) associated with these technologies, and analyzed environmental constraints to petroleum development in this area.

b. Statewide/Regional Population and Economic Forecasts: A non-OCS base case was developed that assumed no significant oil, gas or other mineral development in Alaska beyond current commitments. Forecasts were then prepared for different potential levels of oil and gas development for the proposal in addition to forecasts for each of the deletion alternatives. Forecasts to the year 2000 were made for population, employment, income, and state government fiscal impacts.

c. Impacts on Socioeconomic and Physical Systems: Community facility standards were developed and applied to the non-OCS base case and, in the case of Unalaska/Dutch Harbor, for the mean case of the proposal. The data included education, public safety, recreation and tourism, utilities, housing, local government resources, investments, and capital needs.

d. Impacts on Transportation Systems: A methodology was developed and applied to assess impacts of land-, air-, and water-related transportation. The ability to move goods and materials in and out of the region and throughout the state for the non-OCS base case and for development was assessed.

e. Impacts on the Sociocultural System: Issues analyzed were the traditional use of all resources, including land, marine, and ice environments; subsistence; cultural values; politics; interethnic relationships; social health; and family relationships.

f. Impacts on Commercial Fishing: Conflicts were analyzed between the commercial fishing industry and OCS activities. Issues analyzed include the competition for open space, labor, and infrastructure.

The following is a list of contractors who have conducted research tasks for the proposed St. George petroleum development region: Dames & Moore; Institute of Social and Economic Research, University of Alaska; Alaska Consultants, Inc.; Peat, Marwick, Mitchell and Co.; Kish Tu; Earl Combs and Associates; U.S. Coast Guard; Pacific Northwest Forest and Range Experiment Station of the U.S. Department of Agriculture, Forest Service; the University of Alaska Museum; and Policy Analysts, LTD.

IV.

ENVIRONMENTAL CONSEQUENCES

IV. ENVIRONMENTAL CONSEQUENCES

A. Basic Assumptions for Impact Assessment

Under the terms of the proposed action, 479 blocks for a total of 1,088,371 hectares (2.7 MM acres) would be leased for oil and gas exploration and development. For the block deletion alternatives, the lease areas are as follows: Alternative IV, 929,979 hectares (2.3 MM acres); Alternative V, 777,097 hectares (1.92 MM acres); and Alternative VI, 618,939 hectares (1.53 MM acres). Undiscovered recoverable resources resulting from the mean case of the proposed action are estimated by USGS to be 1.12 billion barrels of oil and 3.66 trillion cubic feet of natural gas. (Also refer to Sec. II.A.)

Efforts have been made within this section to quantify impacts which could result from the proposed lease sale. The mean case was used to quantify probable levels of developmental activity; therefore, all figures are relative to the mean case (refer to Appendix B for a summary of minimum and maximum impacts). There are, however, many areas in which quantification of impacts is difficult due to lack of data and variable factors that affect any potential development. Impact assessment was made to reflect various conditions. They are the probability of interaction (between the leasing alternative and resource), the probability of significant impact should interaction occur and overall probability. The overall probability provides the reader with an estimate of probability of significant impact factored with the probability of occurence.

For each impact analysis all pertinent laws of the United States, including USGS Operating Orders for the OCS, are assumed to be in effect. The Operating Orders and some laws would mitigate certain impacts. Further, the discussion of cumulative effects contained in each impact section is based on the interrelationship of this proposed action as well as other major, current, and proposed projects. Section IV.A.7. contains a discussion of major projects considered in preparation of the cumulative effects assessments.

Because of the many assumptions involved, the analysis is not intended, nor should it be used as, a "local planning document" by potentially affected communities; nor is it a forecast or prediction of the future. All facility locations and scenarios described in this document are intended to represent a few plausible locations and scenarios that presently seem likely. They serve only as a basis for identifying characteristic activities and resulting impacts for this EIS and do not represent a BLM recommendation, preference, or endorsement of facility sites or development schemes.

1. Infrastructure Associated with Exploration: Exploratory support activities for proposed OCS lease sale 70 could emanate from three locations: Cold Bay, St. Paul Island, and Dutch Harbor/Unalaska. Because Cold Bay has superior airport facilities and is reasonably close to the proposed sale area, it is expected to serve as the primary air support site for proposed sale 70 exploratory operations. Personnel and perishable items would arrive in Cold Bay via jet aircraft for further transport to the drill site via helicopter, i.e., IFR-equipped Bell 212's and/or Sirkorsky S-61's. A small support facility would be constructed near the airport. The facility could contain a hangar-warehouse complex, living quarters, offices, and a helipad. The size of the facility may encompass 1.5 hectares (4 acres).

Due to their inadequate air facilities and greater air distance (than Cold Bay) from supply centers in the contiguous United States and Alaska, St. Paul and Dutch Harbor are expected to play a secondary role in air operations, at least through the exploratory phase.

Marine support operations could be conducted almost entirely out of Dutch Harbor. Dutch Harbor's strategic location near Unimak Pass, its good natural anchorage, and its existing infrastructure make Dutch Harbor the best choice for a marine support facility. Barges and/or container ships would offload bulk drilling materials (fuel, cement, mud, tubular goods, etc.) at Dutch Harbor for storage and reloading onto supply boats. Standard design supply boats could be used, and the size of the prospective supply yard may be as large as 4 hectares (10 acres).

Due to possible competition for dock space and land with a vigorous fishing industry, the participating concerns may choose to build their own pier and warehouse complex. However, the oil industry may, if they have difficulty obtaining any type of foothold in the Dutch Harbor area, opt for a marine support scenario similar to that proposed for Norton Sound. (This scenario features warehouse barges or ships anchored near the drill rigs which would supply the needs of the drill vessels. These floating warehouses would be supported by shipments from centers outside the sale area.)

Because of their close proximity to the northern portion of the proposed sale area, St. Paul Island and/or St. George Island could be the site(s) of a marine support facility. However, neither of the islands contains the necessary facilities to handle OCS support activities. Indeed, the islands' undeveloped state and distance from primary supply centers render them unlikely candidates for a marine support base, at least during the exploratory period.

Exploratory drilling within the proposed sale area would probably be carried out by either drill ships or semisubmersibles, with the latter clearly the primary choice. Since the proposed sale area is on the fringe of the Bering Sea ice zone, the drilling season could be variable. During warm years, drilling could continue throughout the year; however, during colder winters, drilling activities would have to be suspended by fall. During an "average" year (if such can be recorded in the Bering Sea), ice conditions could cause a curtailment in drilling operations between the beginning of February and the end of April.

2. Infrastructure Associated with Development: Discovery of recoverable amounts of oil and/or natural gas would trigger a period of intensive construction. This period, termed "the developmental phase," would feature the emplacement of a production infrastructure (i.e., production platforms, pipelines, and loading and terminal facilities) and an expanded transportation system.

Among the wide range of scenarios which could be used to develop the estimated resources of the proposal, four have been chosen which should typify the choices available to the hydrocarbon industry. For one scenario, construction of one or more processing and loading facilities may occur on St. Paul Island; for the second scenario, construction of these facilities at Makushin Bay; for the third scenario, processing and terminal facilities at the edge of a bay on the southern shore of the Alaska Peninsula; and for the fourth scenario, all produced hydrocarbons are processed and loaded offshore.

Two of the three shore facility options are generally ice-free, and VLCC class oil tankers could use these ports in all seasons without the assistance of ice-breaking tugs. However, if the terminal were at St. Paul, ice conditions in some years could force the use of ice-breaking tankers and possibly cause a short-term slowdown in hydrocarbon transport.

Pipeline lengths to each of these locations would vary, but the longest by far would be the pipeline constructed to Makushin Bay. Straight-line distances from Makushin Bay to a point in the center of the proposed sale area compare favorably with other indicated sites. However, due to the depth of the Bering Canyon and the unstable sediments on its slopes, a Makushin Bay pipeline would require extensive rerouting. Refer to Table II.B.4.-1 for a discussion on pipeline length.

The total amount of area allotted to any combined onshore oil and gas processing complex is expected to be 200 to 225 hectares (500-550 acres). This figure includes any required oil treatment facility and accommodations for plant personnel and may be somewhat high. A lack of easily developable land in most of the areas under consideration for facility development may require industry to design more compact processing systems and living quarters.

The crude oil terminal should be able to treat an average of 133 million barrels per day (with a peak average of 633 MMbbls per day) and have a storage capacity of some 6 to 7 days' production. The liquefaction facility for natural gas would probably be based on an air-cooling process and would not require large volumes of water for any phase of operation except its initial testing period. Average daily processing capacity is expected to be around 320 million cubic feet per day; however, during the peak year of production, the plant would have to liquefy some 700 million cubic feet per day.

Types of production platforms used within the proposed sale area are expected to be pile-founded, thick, ice-resistant steel and/or concrete structures, with subsea completions used to produce marginal satellite fields. Due to the lengths of the pipelines used to develop the resources of the proposal, one or more platforms would be needed to function as compressor/booster station(s).

If offshore processing and loading were to occur, several developmental options as well as platform types could be used. In view of the area's tendency to storms as well as ice movement, it is possible that large concrete or steel (or a hybrid of both) gravity structures would be erected to function as an offshore terminal. Concrete gravity structures have functioned effectively in the North Sea and could be adapted for use in the southern Bering Sea. These gravity structures can weigh as much as 300,000 tons and store several million barrels of oil. Since their fabrication is possible only at a deepwater facility located next to a major industrial infrastructure, it is probable that the platforms would be constructed outside of Alaska. (Possible site locations for construction are the Puget Sound (for concrete) or Japan (for steel).) Once constructed, the platform--relying on the buoyancy in its storage tanks--would be towed to site. This would take several weeks, and the tow course would pass through an extremely active storm zone. (ARCO Alaska, Inc.

has stated that towing these structures is not beyond industry's current capabilities and that in this analysis their use should not be ruled out (personal communication). Since gravity structures are prone to damage by earthquakes, the platforms would have to be placed in the northern portion of the proposed sale area away from the Aleutian seismic shadow. Once in place, these installations would be joined by pipeline to production platforms and would commence crude oil treatment and gas liquefaction activities.

Construction workers would likely be housed in temporary quarters near the construction sites. Should the resources of the proposed action be developed using an "offshore scenario," workers could be quartered on a hotel platform similar to those in use in the North Sea. Workers engaged in later production phase activities (i.e, processing and transport) could eventually occupy the same temporary housing used by the construction workers.

3. Infrastructure Associated with Production: Production phase activities should be limited to hydrocarbon processing, loading, maintenance, and administrative activities. However, subsequent sales within the vicinity of the proposed sale area may expand the size and scope of forecast infrastructure.

For a further discussion of basic assumptions used in analyzing impacts, see Section II.B.1. and Alaska OCS Office Technical Paper No.1 (Tremont, 1981).

a. Estimated Resources and Activities Based on the Minimum Case of the Proposed Action: The oil and gas resources forecast for the minimum case of proposal are 240 million barrels of oil and 1.480 trillion cubic feet of natural gas according to the USGS. Peak annual production of oil is expected to occur in 1990 with the production of 65 million barrels. Natural gas could peak in 1993 with an output of 118 billion cubic feet. Production of resources could begin by 1989 with oil and gas reserves exhausted by the 24th and 33rd year, respectively, after the sale date.

Exploratory activities could begin by 1983 and continue through 1987. During this period, it is estimated that some 40 wells would be drilled. During this time frame, a maximum number of 4 drilling rigs could be expected to be working at any one time. Exploratory support bases and supply patterns hypothesized for the minimum case are expected to be the same as those assumed for the proposed action. Air support could originate from the Cold Bay airfield, while marine support might issue from a base near Unalaska.

Developmental and construction activities are assumed to begin in 1985 with the emplacement of the first of eight platforms. Development and construction activities would continue until 1990. Some 82 production wells may be drilled and up to 955 kilometers (593 mi) of pipeline laid.

Given the resources estimated for the minimum case, it is questionable whether an elaborate production infrastructure would be constructed. It is possible that a more cost-effective method of producing the hydrocarbons may feature the extraction, processing, and loading of the product offshore. Produced natural gas, however, would probably be reinjected to retain formation pressure. Estimated quantities of natural gas appear to be marginal for economic production. Nevertheless, should the hydrocarbons be transported to shore by pipeline, potential terminal locations would not differ from those described for the mean case.

Platform types that could be used during the exploratory, development, and production phases are not expected to differ from those considered for the mean case of the proposed action.

b. Estimated Resources and Activities Based on the Maximum Case of the Proposed Action: The oil and gas resources forecast for the maximum case of the proposed action are 3.04 billion barrels of oil and 8.80 trillion cubic feet of natural gas according to the USGS. Peak annual output of oil is expected to occur in 1991 with the production of 659 million barrels. For natural gas annual output is expected to peak in 1993 with the processing of some 623 billion cubic feet. Production of resources could begin by 1989 with the exhaustion of oil reserves occurring 29 years after the sale date (2011) and the exhaustion of gas reserves occurring 38 years after the sale date (2020).

Exploratory activities could begin by 1983 and continue through 1987. In the exploratory period it is estimated that some 60 wells could be drilled. A maximum of five drilling rigs are expected to be working during this period. Logistics, bases, and supply patterns expected to be used to develop the resources of the maximum case should not differ greatly from those which are assumed for the mean case.

Air support activities could issue from Cold Bay and, secondarily, from St. Paul. Marine support activities are expected to issue from Unalaska.

Development and construction activities are expected to begin in 1986 with the emplacement of the first 2 of 17 production platforms. Development and construction activities could continue until 1993. Within that time, some 699 development wells may be drilled and up to 1,124 kilometers of pipe laid. Employment during this period is expected to peak in 1989, at 6,000 workers per month.

Produced hydrocarbons could be transported to one or, possibly, two of the locations indentified for the mean case transportation scenario. Average monthly employment during the production period would vary between 2,700 and 3,500 workers until the year 2012, at which time employment would be reduced by about 50 percent.

4. Oilspill Risk Analysis:

a. Estimated Quantity of Resource: Considerable uncertainty exists in estimating the volume of oil that may be discovered and produced as a result of an OCS lease sale. The estimated oil resources used for the oilspill risk calculations correspond to mean case estimates in this environmental impact statement (Sec. II.A.). There is, however, an important qualification in the way these estimates are used in this document. The resource estimates used in predicting the number of spills expected over the life of the field, and in the oilspill risk analysis for this environmental impact statement, are based on the "unrisked" mean estimates; that is, the assumption that the resource will be discovered. For the proposed sale area, the likelihood of finding commercial quantities of oil is 28 percent. Obviously, if oil is not discovered (a 72% probability), there would be no oilspill risks. The predicted number of spills, and accordingly, the results of the oilspill risk analysis, reflect the expected oilspill risk based on the mean resource estimate.

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b. Probability of Oilspills Occurring: The probability of oilspill occurrence is based on the fundamental assumption that realistic estimates and future spill frequencies can be based on past OCS experience. This analysis assumes that spills occur independently of each other, and that the spill rate is dependent on the volume of oil produced or transported. This last assumption--spill rate is a function of the volume of oil handled--might be modified on the basis of size, extent, frequency, or duration of the handling. In the case of tanker transport, for example, the number of port calls and the number of tanker years have been considered (Stewart, 1976; Stewart and Kennedy, 1978). Our analysis uses volume of oil handled, because other bases for estimates of spill frequency are necessarily derived from this quantity.

This analysis examines spills in two size ranges (where data permits): 10,000 barrels or greater, and 1,000 barrels or greater (which also includes 10,000 bbls and greater spills). To place these sizes in a rough perspective to the type of accident usually involved, spills in the largest category are usually associated with catastrophies such as large blowouts or shipwrecks. Accidents in the second category typically include these and other serious events, such as structural failures and collisions. The choice of which size to use depends upon the analysis being performed. If, for example, a particular impact could occur only from a massive oil slick, then only large spills should be examined.

Accident rates for platforms on the U.S. OCS were derived from USGS accident files for Gulf of Mexico (USDI, 1979) and California (USDI, 1979) and from USGS production records (USDI, 1980) (there has been no oil production in the Alaska OCS). For spills of 1,000 barrels or larger, a period from 1964-1979 was used. Between 1964-1979, there were 4 spills 10,000 barrels or larger, and 9 spills (including the 4) 1,000 barrels or larger. During this period, U.S. OCS oil production was 4,386 million barrels.

USGS accident files are also a major source of data for pipeline accidents. As with platforms, the period from 1964-1979 was used for spills of 1,000 barrels or larger. The USGS files include 2 spills over 10,000 barrels and 7 spills (including the 2) over 1,000 barrels. Devanney and Stewart (1976) report 6 additional pipeline spills; all, except one of 1,020 barrels, occurred in coastal channels. Adding this one spill to the USGS data gives a total of 8 spills of 1,000 barrels or larger. Since nearly all of U.S. OCS production has been transported to shore by pipelines, the same production statistics used for platforms can be applied to the pipeline accident rate.

Tanker accident rates were derived from published literature. The tanker accident rate for spills of 1,000 barrels or larger is from Stewart (1976): 178 spills per 45,941 million barrels transported. There is, unfortunately, no detailed listing of these spills in the published literature. However, Devanney and Stewart (1974), examining tanker spills on major trade routes, reported 99 spills greater than 42,000 gallons (1,000 barrels), 87 spills greater than 100,000 gallons, and 32 spills greater than 1 million gallons. Interpolation of this data gives about 53 spills greater than 10,000 barrels or about 54 percent of the 1,000-barrel spill rate. This estimate is supported by listings of spills in Oilspill Intelligence Reports (1979-1980) where, out of 22 spills of crude oil from carriers reported from 1978 and 1979, known or estimated to be larger than 1,000 barrels, 15 or 68 percent were larger than 10,000 barrels. Therefore, a ratio of 60 percent of the 1,000-barrel rate appears reasonable, giving an estimated spill rate for 10,000 barrels and larger spills of 107 per 45,941 million barrels.

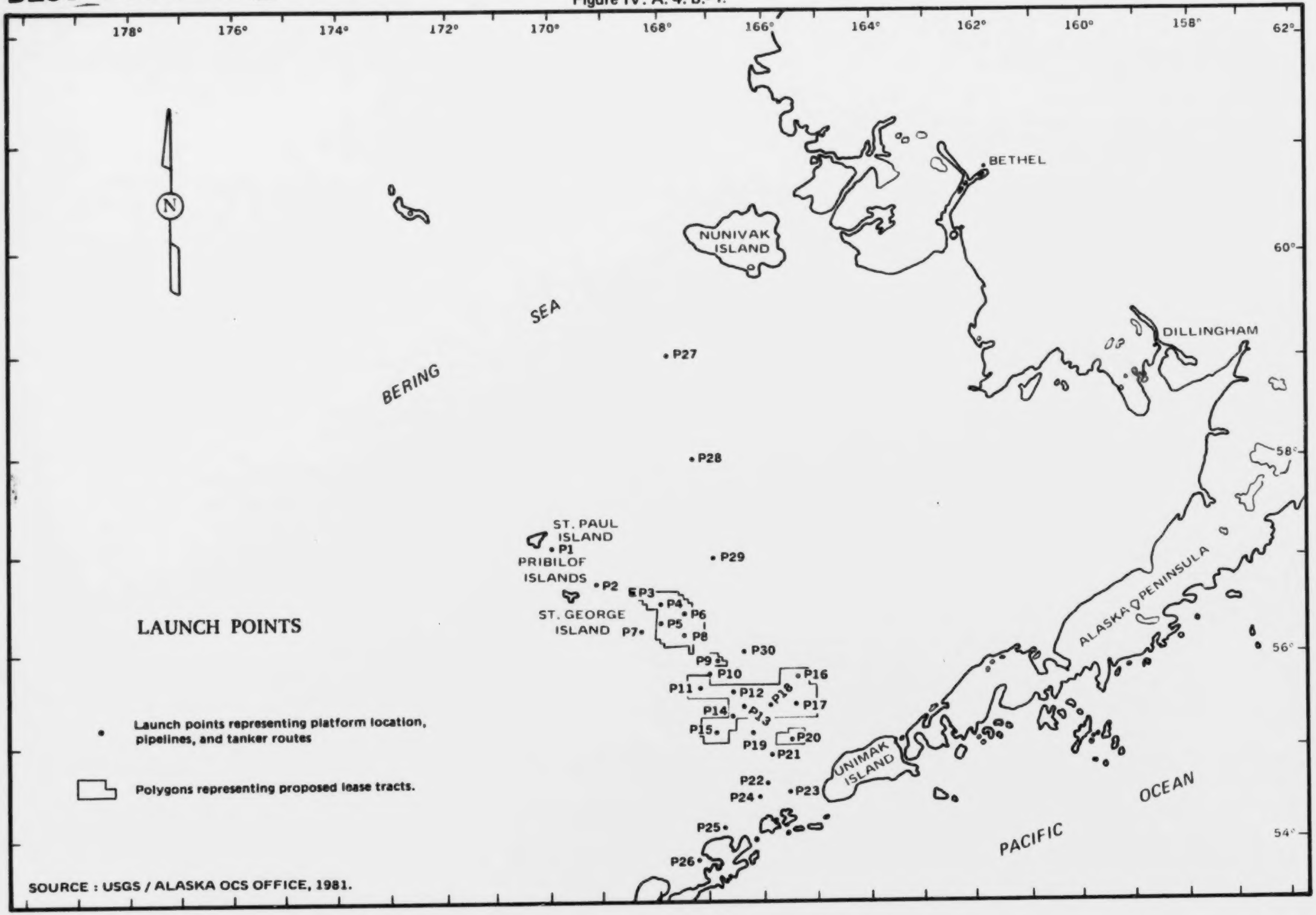
In summary, the spill rates used in this document are:

	Spills Per Billion Barrels	
	1,000 bbl	10,000 bbl
Platforms	2.05	0.91
Pipelines	1.82	0.46
Tankers	3.87	2.32

Are these rates applicable to Alaska, since most of the existing data are from more temperate climates? About 520 million barrels of petroleum have been produced from platforms in Cook Inlet and moved to shore via pipe; no spills of 1,000 barrels or greater have occurred since 1971. Applying the spill rates used in this analysis, there is a 13-percent chance of no spills in producing and transporting 520 million barrels in this manner. Thus, the data base for Alaska (520 MMbbls) is still too small to say, with a high degree of confidence, that the Alaskan spill rate differs from the rate for the rest of the U.S. outer continental shelf. This conclusion, however, will need to be reviewed as the commendable safety record of Alaskan operations continues.

The modeled study area and the proposed blocks are shown in Figure IV.A.4.b.-1, as are the launch points which represent possible platform locations, pipeline routes, and tanker routes. In much of the impact analysis for sale 70, a transportation scheme has been arbitrarily assumed of transporting oil by pipeline to a terminal located on the south side of the Aleutian Islands or Alaska Peninsula. From there, the oil could be transported south by tankers. In the Oilspill Risk Analysis, this transportation scheme is identified as Scenario A and has the further assumption that the terminal is located at Ikatan Bay (Fig. IV.A.4.b.-2). In addition to oil production from the proposed sale 70 lease tracts, if oil is produced from the proposed Norton Sound OCS lease sale 57 area, it may be transported by tanker through the St. George Basin area. Thus, a cumulative analysis was performed which considered oil production with transportation Scenario A from the proposed sale 70 lease tracts along with tankering of oil (produced in the proposed Norton Sound leases) through the St. George Basin study area (Fig. IV.A.4.b.-3). Oil from proposed lease sale 75, the North Aleutian Basin, is not included in this oilspill risk analysis. The cumulative case of proposed sales 57, 70, and 75 will be considered in the draft EIS for sale 75. Three additional potential oil transportation scenarios (B through D) were analyzed for the proposed action and deletion alternatives in the Oilspill Risk Analysis (Figs. IV.A.4.b.-4 through -6). Note that all transportation scenarios are hypothetical and are put forth only to aid in analyzing possible impacts. Use of any transportation route would depend both on finding commercial quantities of oil and where that oil is found. In transportation Scenario B, all the oil would be moved via pipeline to a terminal on St. Paul Island. From there the oil would be transported by tanker south through Unimak Pass. In transportation Scenario C, all the oil would be transported via pipeline to a terminal located near Makushin Bay on Unalaska Island. In the Oilspill Risk Analysis, the assumption is made that from there the oil would be transported

Figure IV. A. 4. b.- 1.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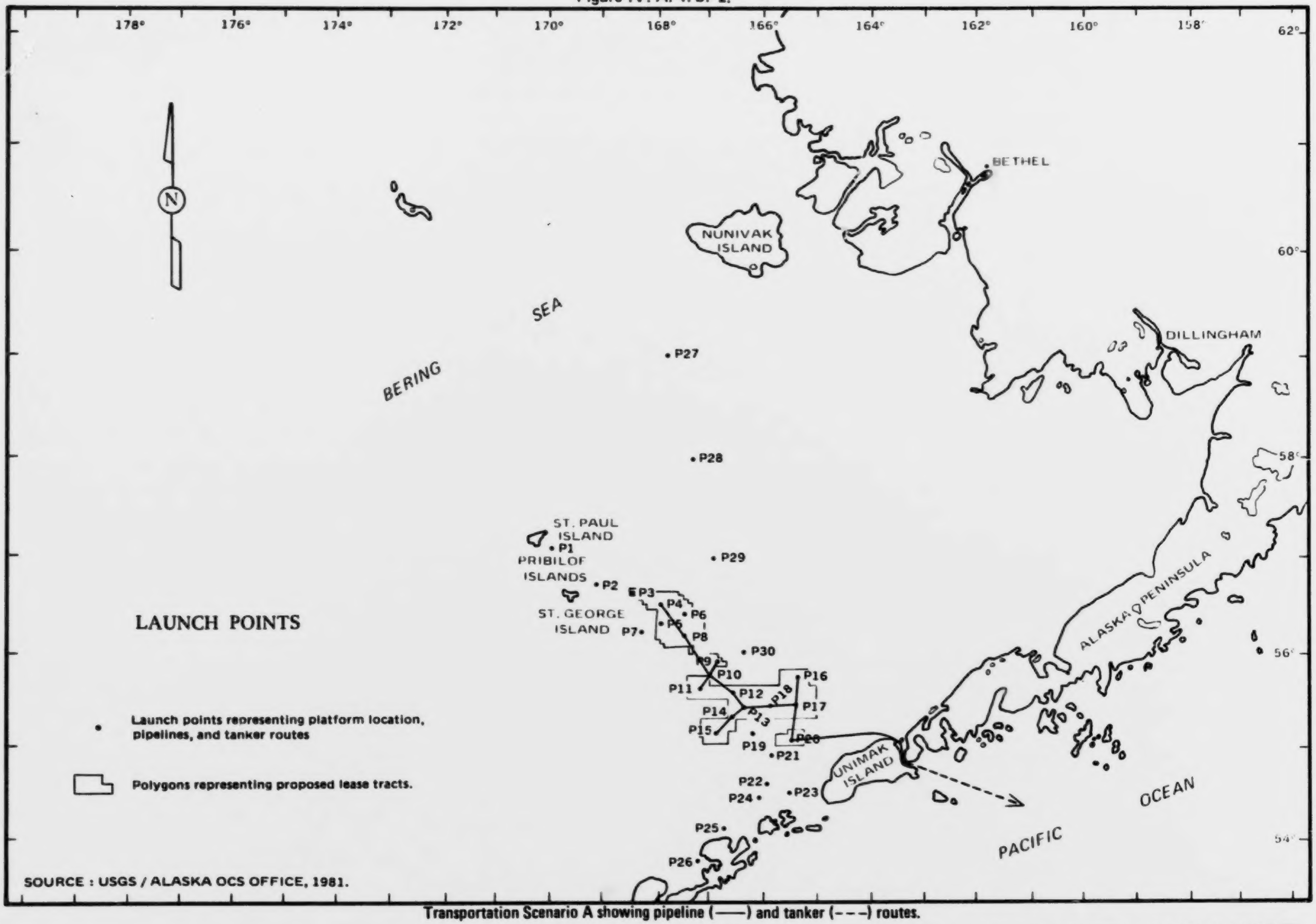
● Launch points representing platform location, pipelines, and tanker routes
Polygons representing proposed lease tracts.

SOURCE : USGS / ALASKA OCS OFFICE, 1981.

Figure IV. A. 4. b.- 2.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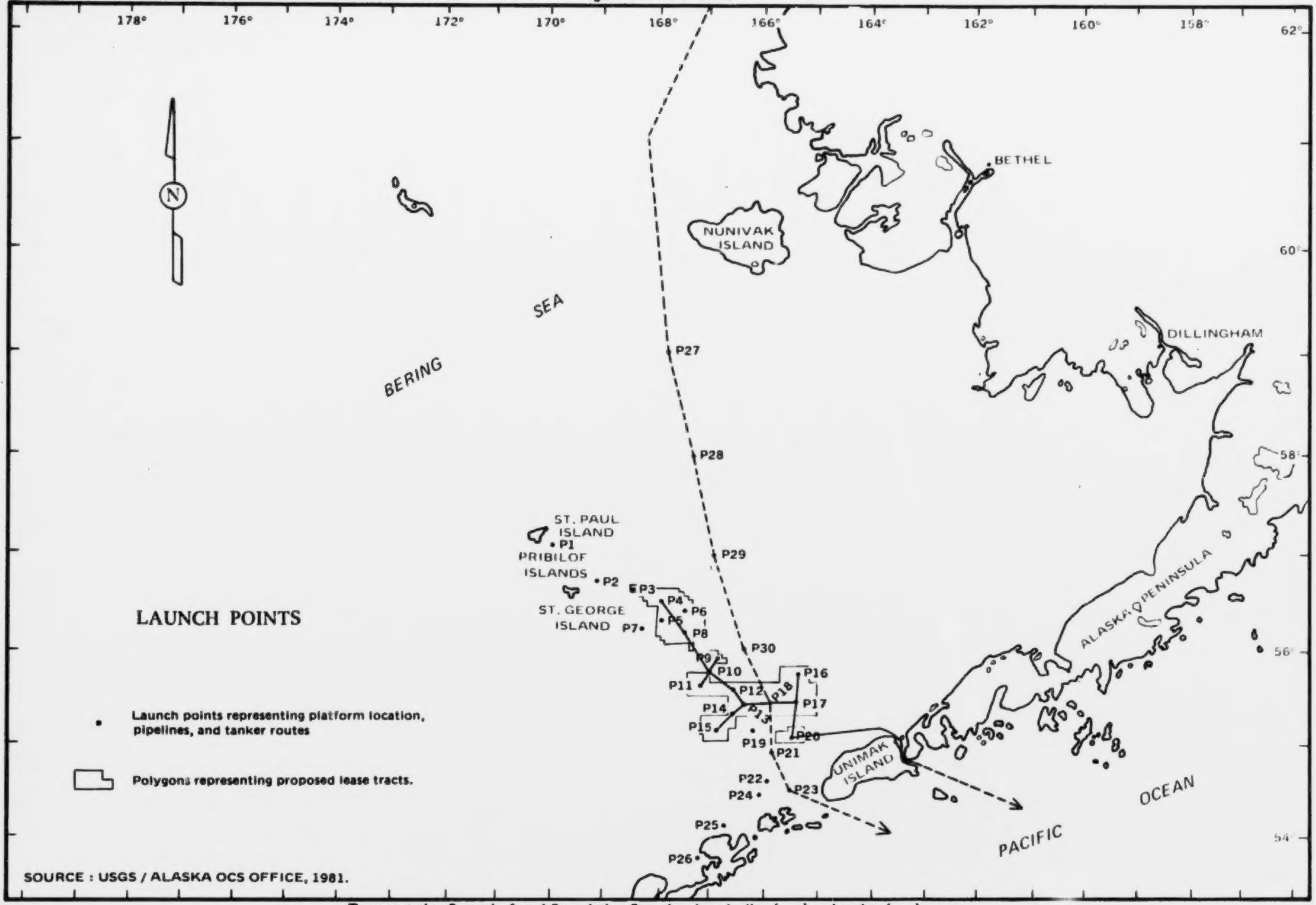
Launch points representing platform location, pipelines, and tanker routes
Polygons representing proposed lease tracts.

SOURCE : USGS / ALASKA OCS OFFICE, 1981.

Transportation Scenario A showing pipeline (——) and tanker (– – –) routes.

Figure IV. A. 4. b.-3.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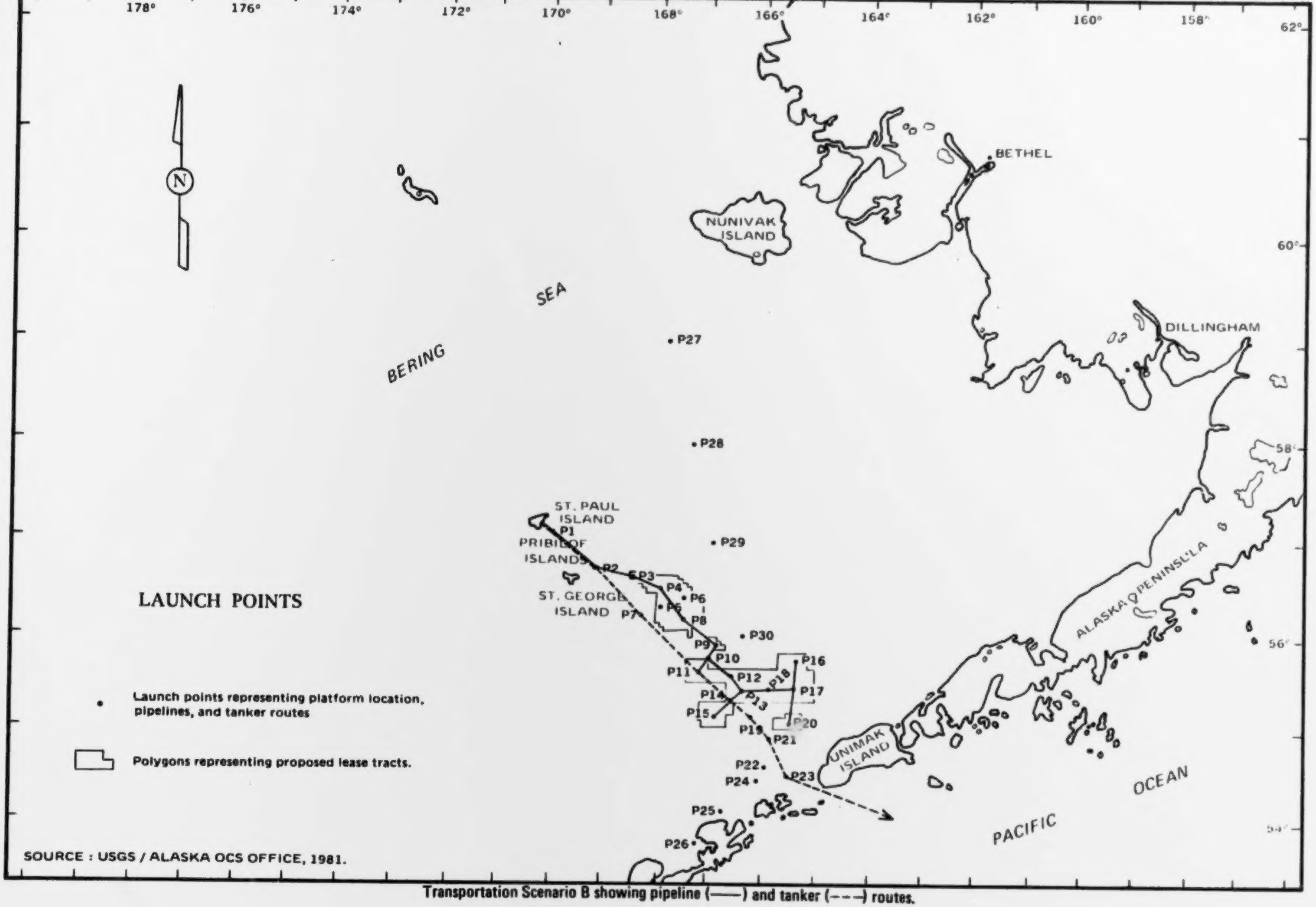
Launch points representing platform location, pipelines, and tanker routes
Polygons representing proposed lease tracts.

SOURCE : USGS / ALASKA OCS OFFICE, 1981.

Transportation Scenario A and Cumulative Case showing pipeline (—) and tanker (---) routes.

Figure IV. A. 4. b.-4.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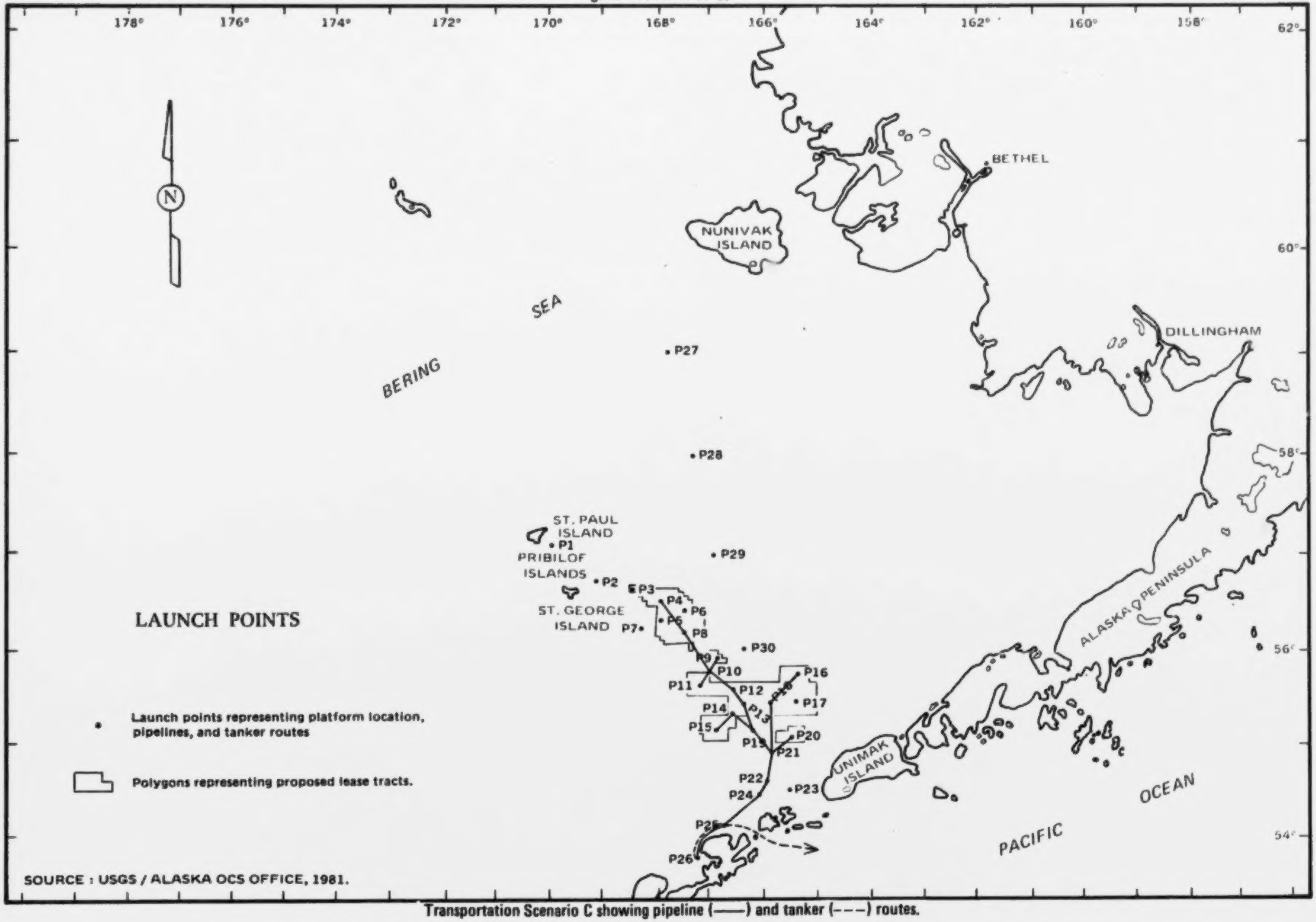
LAUNCH POINTS
Launch points representing platform location, pipelines, and tanker routes
Polygons representing proposed lease tracts.

SOURCE : USGS / ALASKA OCS OFFICE, 1981.

Transportation Scenario B showing pipeline (——) and tanker (- - -) routes.

Figure IV. A. 4. b.-5.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LAUNCH POINTS
Launch points representing platform location, pipelines, and tanker routes
Polygons representing proposed lease tracts.

SOURCE : USGS / ALASKA OCS OFFICE, 1981.

Transportation Scenario C showing pipeline (——) and tanker (- - -) routes.

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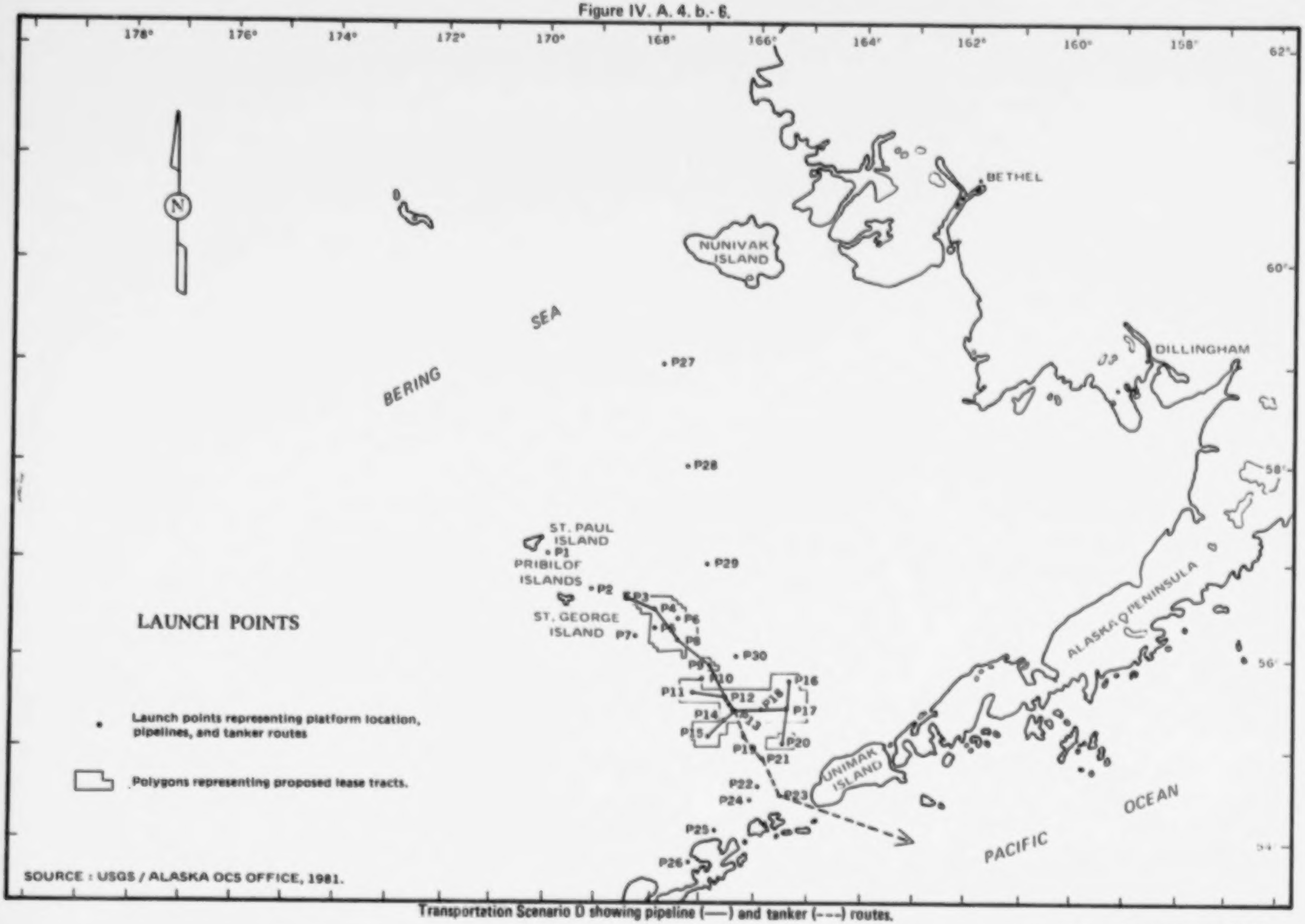
Figure IV. A. 4. b.- 6.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Launch points representing platform location, pipelines, and tanker routes
Polygons representing proposed lease tracts.
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SOURCE : USGS / ALASKA OCS OFFICE, 1981.

Transportation Scenario D showing pipeline (—) and tanker (---) routes.

south by tankers through Akutan Pass. In transportation Scenario D, all the oil would be moved via pipeline to a central location near launch site P12 (Fig. IV.A.4.b.-6); from there the oil would be transported south by tankers through Unimak Pass.

In addition to the proposed action (Alternative I), three block deletion alternatives were considered: Pribilof (Alternative IV), Unimak (Alternative V), and the combination of the two (Alternative VI). These deletions are identified in Section II.B. and Appendix E (Fig. E.-1). Further rationale and explanation of proposed deletions and transportation scenarios are given in Section II.B. and in Alaska OCS Technical Paper No. 1 (Tremont, 1981).

An assumption is made for the oilspill risk analysis that only one-half of the oilspill risk from tankers occurs in the study area. This is because only a fraction of the entire tanker route lies within the study area. Oilspills could occur on that part of the route which lies outside the study area. In this analysis, tanker transportation of oil was only considered within the boundaries of the study area. This is because the Rand Model for oilspill trajectories (Liu and Leendertse, 1981) was bounded by the Aleutian coast. It did not include the area of North Pacific Ocean lying to the south of the Aleutian Islands and the Alaska Peninsula. The necessary oceanographic data base needed to expand the model to this area does not exist. Thus transportation Scenario A does not include any tanker transportation of oil.

Spill frequency estimates were calculated for production and transportation of oil from proposed sale 70. Table IV.A.4.b.-1, based on the spill rates described earlier, shows the statistically expected number of spills that could occur during the expected production life of the proposed St. George Basin lease area. The number of spills was calculated for the unrisked mean estimate. (For the purposes of the analysis, one must assume that the estimated mean resource would be found.) Note that spills of 1,000 barrels or greater are expected to occur about two-to-three times as frequently as the larger spills of 10,000 barrels and greater.

In addition to the larger oilspills, smaller but more frequent spills can be expected. Extrapolation of the oil industry record for oilspills of less than 1,000 barrels in upper Cook Inlet (Table V.C.1.-1 of sale 60 Final Environmental Impact Statement (USDI, 1981)) to the proposed St. George Basin sale area, gives an estimate of about 600 additional oilspills for the unrisked, mean case estimate of reserves, but these additional spills average only 38 barrels each. Oilspills of 50 barrels or less are thought to constitute only a quarter of total spillage from offshore oil industry (National Academy of Sciences, 1975).

Also, the causes of these smaller spills differ from those of spills of 1,000 barrels and greater. Larger spills are caused by major natural disasters or major accidents, usually entailing loss of life and property. Smaller spills tend to be caused by human error or carelessness and can be considered potentially mitigatible; for example, by better training or operating procedures. These small spills, therefore, have not been included as an additional category in this analysis.

As mentioned previously, transportation Scenario A does not include any tanker transportation of oil (only pipelines) within the boundaries of the Rand

Table IV.A.4.b.-1
Oilspill Probability Estimates for Spills in the Bering Sea Greater than 1,000 and 10,000 Barrels Resulting from Proposed OCS Lease Sale 70[1]

	Mean	Expected Approximate Number of Spills (Mean)		Probability (% Chance) of One or More Spills	
	(Bbbls)	≥1,000 bbls	≥10,000 bbls	≥1,000 bbls	≥10,000 bbls
Proposed Action					
(Scenario A)[2]	1.12	4.3	1.5	99	79
(Scenario B-D)	1.12	6.5	2.8	99+	94
Pribilof Deletion (Alt.IV)					
(Scenario A)[2]	1.00	3.9	1.4	98	75
(Scenario B-D)	1.00	5.8	2.5	99+	92
Unimak Deletion (Alt. V)					
(Scenario A)[2]	0.59	2.3	0.8	90	55
(Scenario B-D)	0.59	3.4	1.5	97	77
Pribilof and Unimak Deletion (Alt. VI)					
(Scenario A)[2]	0.47	1.8	0.6	83	45
(Scenario B-D)	0.47	2.7	1.2	93	70
Proposed Action Plus Tankering of Existing Oil from Norton Sound					
(Scenario A)	1.60	5.3	2.1	99+	88
(Scenario B-D)	1.60	7.4	3.4	99+	97

1/ Numbers and probabilities are unrisked mean estimates (assumes that the mean resource estimate would be discovered and produced).

2/ Transportation Scenario A does not include tanker transportation of oil within the Bering Sea.

Sources: USGS/Alaska OCS Office, 1981.

Model. Thus, the expected number of oilspills (proposed action) for this scenario is less than the expected number of oilspills for transportation Scenarios B through D (which include both pipelines and tankers). If the model had been expanded to include tanker transportation on the southern side of the Aleutian Islands and Alaska Peninsula in transportation Scenario A, then under the assumptions of the model, the expected number of oilspills for this scenario (proposed action) would be identical to those for transportation Scenarios B through D. This same idea can be applied to Alternative IV through VI and the cumulative analysis (proposed action plus tanker transportation of Norton Sound oil). Table IV.A.4.b.-1 shows only the oilspill risks for the Rand Model study area. If the model had included the tanker transportation on the southern side of the Aleutian Islands and Alaska Peninsula, the oilspill risks would have changed from Table IV.A.4.b.-1 to estimates of spills as follows:

	Expected Number of Spills (mean)		Probability (% chance) of one or More Spills	
All Scenarios	≥1,000	≥10,000	≥1,000	≥10,000
Alternative IV (Pribilof Deletion)	5.8	2.5	99+	92
Alternative V (Unimak deletion)	3.4	1.5	97	77
Alternative VI (Pribilof and Unimak Deletion)	2.7	1.2	93	70
Proposed Action Plus Tankering of Existing Oil From Norton Sound	7.4	3.4	99+	97

However, even excluding these additional probable spills south of the Bering Sea, the risk of oilspills is high. For the proposal with any of the four transportation scenarios, there is at least a 99-percent chance of one or more oilspills of 1,000 barrels or greater over the lifetime of the field if the estimated mean case oil reserves are found. There is also a 79-percent chance with Scenario A and 94-percent chance with Scenarios B though D of at least one oilspill of 10,000 barrels or greater. Of the deletion alternatives, Alternative VI, the combined Pribilof and Unimak deletion, results in the greatest reduction in risk: to 83 percent for Scenario A and 93 percent for Scenarios B through D for at least one oilspill of 1,000 barrels or greater and to 45 percent for Scenario A and 70 percent for Scenarios B through D for at least one oilspill of 10,000 barrels or greater.

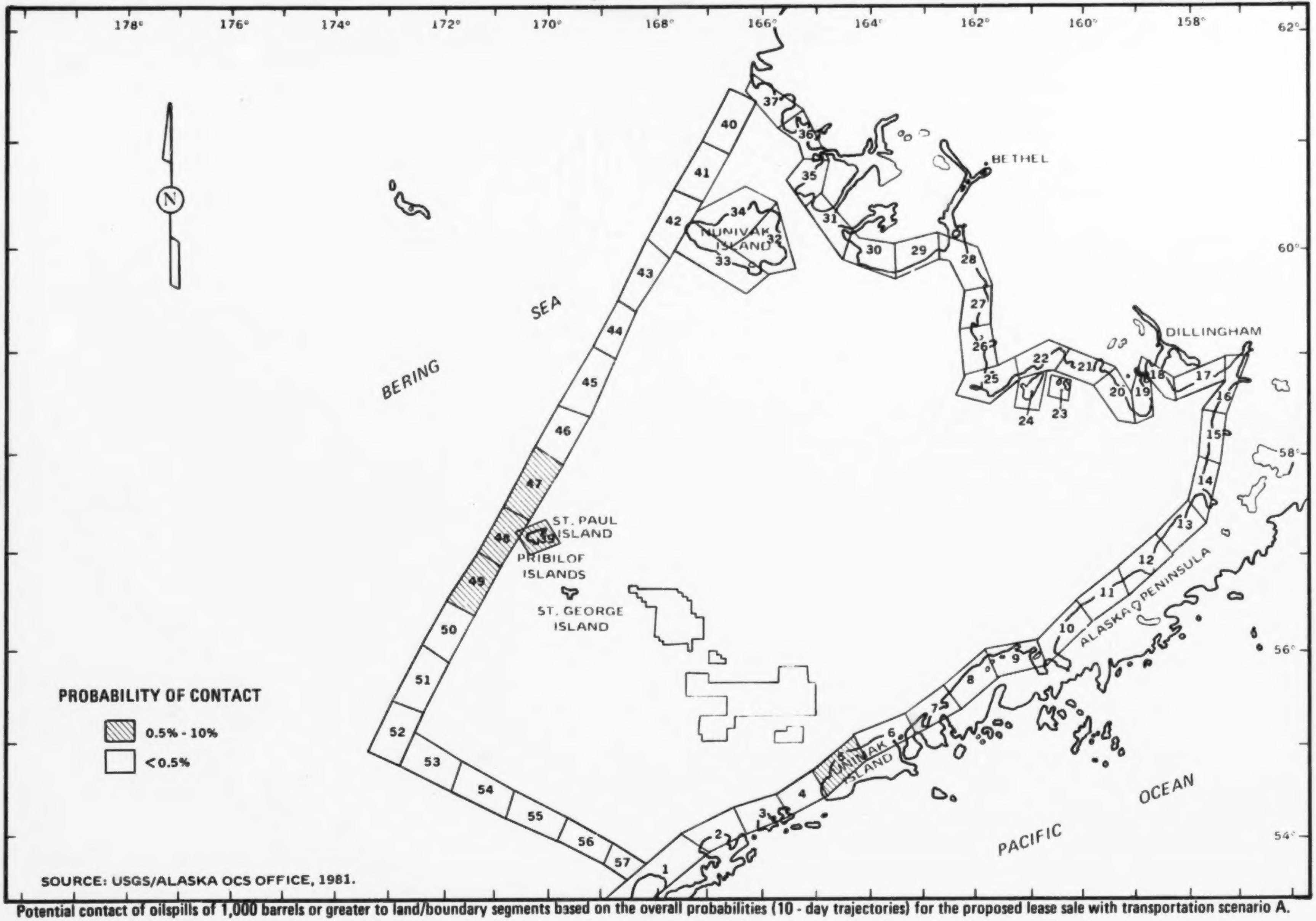
c. Oilspill Trajectories Simulations: Oilspill trajectories were simulated by the Rand Corporation in Santa Monica, California, using Rand's three-dimensional model for estuaries and coastal seas (Liu and Leendertse, 1979, 1981). Thirty launch points were selected as being representative of platform locations, pipelines, and tanker routes in the proposed sale area (Fig. IV.A.4.b.-1). In this analysis, the location of the center of mass for each hypothetical oilspill was reported every 12 hours. Oilspill trajectories were simulated under three sets of environmental conditions. The first set, which included the months of December to May, was termed winter conditions. During this period, the bulk of the study area (and model) is only occasionally covered by ice floes. For each winter launch point, 10 oilspills were simulated under different weather and ice scenarios. The second set of trajectories was an ice-free condition, from June to August. Because of the variability of the weather during this period, 20 hypothetical spills were launched from each site. The third set of trajectories was also an ice-free condition from September through November. During this period, ten hypothetical oilspills were again launched from each site. The trajectories for these three seasonal conditions were calculated by the Rand Corporation and transmitted to the USGS, Reston, Virginia, on compatible computer tapes. These trajectories were then applied to land/boundary segments and biological resources provided by the BLM to determine the environmental risk factors (Samuels et al., 1981; Appendix E).

It should be emphasized that the trajectories simulated by the model represent only hypothetical pathways of oil slicks, and do not involve any direct consideration of cleanup, dispersion, or weathering processes which could determine the quantity or quality of oil that might eventually come in contact with targets. An implicit analysis of weathering and decay can be considered by knowing the age of simulated oilspills when they contact targets. For this analysis, three time periods were selected: 3 days--to represent diminished toxicity of the spill, 10 days--to allow for the deployment of cleanup equipment, and 30 days--to represent the difficulty of tracking or locating spills after this time.

Results of the trajectory simulations are presented in terms of conditional and combined probabilities. The probability of an oilspill contacting either land/boundary segments or biological resources from the given launch points (Fig. IV.A.4.b.-1) are termed conditional probabilities. These probabilities do not include the likelihood of a spill occurring or, in other words, do not include the expected spill rate. The assumption is made in calculation of these conditional probabilities that a spill has occurred from the respective launch points. The conditional probabilities represent the percentage chance of oil contacting specific land/boundary segments and biological resources (Appendix E, Tables E-1 through E-9). The size of land/boundary segments was set as the minimum that could be effectively used within the resolution of the model (see Fig. IV.A.4.c.-1). These probabilities are useful in identifying those areas that pose the highest risk to specific targets and land/boundary segments should spills occur.

The conditional probabilities were combined in the analysis with the expected spill rates based on the unrisked mean resource estimates to yield the overall, combined probabilities. The combined probabilities for biological resources for the proposed sale and each alternative are discussed in Sections IV.B. through G. of this Draft Environmental Impact Statement and those of land/boundary segments are discussed below. A complete listing of these combined probabilities is given in Appendix E, Tables E-10 to E-57.

Figure IV. A. 4. c. - 1.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PROBABILITY OF CONTACT
▨ 0.5% - 10%
☐ <0.5%

SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for the proposed lease sale with transportation scenario A.

Tables E-34 through E-39 in Appendix E give cumulative, combined probabilities of spills attributable to both this proposal (assuming that commercial quantities of oil are found) and to tankering of oil from the proposed sale 57 area of Norton Sound, through the St. George Basin and Unimak Pass. Note that the probability of spills assigned to the tankering of oil from Norton Sound is unrisked, the assumption is made that commercial quantities of oil (480 million barrels, Draft Environmental Impact Statement sale 57 [USDI, 1981]) will be found in the proposed Norton Sound lease area. There is an 86 percent chance that these quantities of oil will not be found.

Combined probabilities that a spill would occur and contact shores of the study area are shown for the proposal, the cumulative case, and each of the deletion alternatives in Table IV.A.4.c.-1. For the proposal, transportation Scenario A would have no chance of a 1,000-barrel or greater oilspill contacting land over 3 days, 12-percent chance over 10 days, and 60-percent chance over 30 days. Over 10 days, risk of land contact occurs only to part of Unimak (4%), St. Paul Island (4%), and probably St. George Island (not analyzed) (Fig. IV.A.4.c.-1). Factoring of tankering of Norton Sound oil into the analysis results in no additional risk of oilspills over 3 days, 4-percent additional risk over 10 days, and 11-percent additional risk over 30 days. The major change is the presence of possible but slight risk to Nunivak Island (Fig. IV.A.4.c.-2). There is a slight increase in risk along Unimak Pass and Unimak Island.

Use of one of the other transportation scenarios in the proposal would result in higher risk to land by oilspills, particularly over shorter, more critical time periods. Transportation Scenario B, a St. Paul Island terminal, would result in 21-percent risk over 3 days and 39-percent risk over 10 days for a 1,000-barrel or greater spill. The land segment most at risk would be St. Paul Island at 19 percent (Fig. IV.A.4.c.-3). Transportation Scenario C, a Makushin Bay terminal, would result in 16-percent risk over 3 days and 57-percent risk over 10 days, the latter risk almost fivefold higher than in Scenario A. This increase in 10-day risk is attributable to higher probability of oilspills reaching the northern side of the Aleutian Islands (Fig. IV.A.4.c.-4). Transportation Scenario D, offshore loading (Fig. IV.A.4.c.-5), has risks only slightly greater than those of Scenario A. Inclusion of tankering of Norton Sound oil through the proposed sale 70 lease area would not appreciably increase risk over that of the proposal for any of the transportation scenarios.

Alternative IV, the Pribilof deletion, does little to mitigate risk of land contact. For Scenario A, risk of oilspill contact with land through 10 days is reduced from 12 percent in the proposal to 8 percent. Reductions of risk for other transportation scenarios are also only a few percentage points less than for the same scenarios in the proposal. Scenarios B and C, therefore, are still much higher in oilspill risk to land than is Scenario A (Fig. IV.A.4.c.-6 to -8). Risk to land from a 1,000-barrel or greater oilspill with transportation Scenario D in Alternative IV, at 13 percent through 10 days, is slightly higher than in scenario A in either Alternative IV or proposal (Fig. IV.A.4.c.-9). Inclusion of tankering of Norton Sound oil through the proposed sale 70 lease area in the analysis would effect each transportation scenario equally, increasing 10-day risk by about 4 percentage points.

Table IV.A.4.c.-1
Combined Probabilities (% Chance) of an Oilspill Contacting Land within 3, 10, and 30 Days over the Production Life of the Field[1] [2]

	3 Days		10 Days		30 Days	
	≥1,000 bbls	≥10,000 bbls	≥1,000 bbls	≥10,000 bbls	≥1,000 bbls	≥10,000 bbls
Proposal						
(Scenario A)	N	N	12	5	60	27
(Scenario B)	21	10	39	18	82	54
(Scenario C)	16	9	57	34	86	58
(Scenario D)	N	N	18	9	75	47
Cumulative Case (Proposal with Scenario A and Tankering from Norton Sound)[3]	N	N	16	8	71	40
Alternative IV - Pribilof Deletion						
(Scenario A)	N	N	8	3	58	27
(Scenario B)	17	8	33	15	79	50
(Scenario C)	15	8	52	31	31	55
(Scenario D)	N	N	13	7	7	45
Alternative V - Unimak Deletion						
(Scenario A)	N	N	10	4	26	10
(Scenario B)	14	6	29	13	75	31
(Scenario C)	9	5	37	21	57	32
(Scenario D)	N	N	14	6	42	23
Alternative VI - Pribilof and Unimak Deletion						
(Scenario A)	N	N	6	2	21	8
(Scenario B)	10	4	22	9	47	25
(Scenario C)	7	4	29	16	50	27
(Scenario D)	N	N	9	4	35	19

N = Less than 0.5 percent

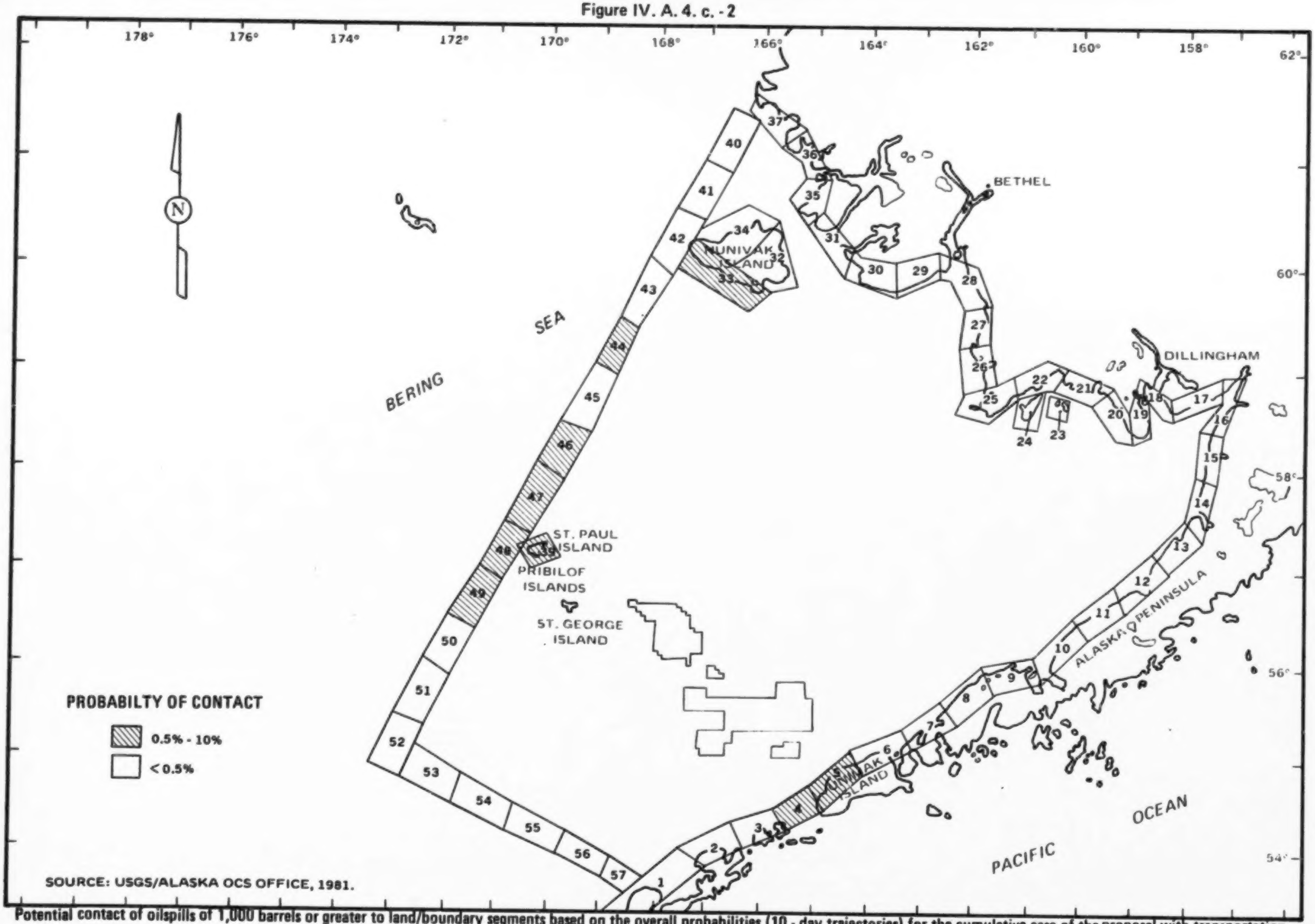
[1] Based on unrisked estimate which assumes the mean resource estimates for the proposed action and each alternative will be discovered and produced.

[2] Assumes probability of spill reaching St. George Island (not considered in OSRA) identical to that of St. Paul Island.

[3] Includes only land segments bordering St. George Basin study area.

Source: USGS/Alaska OCS Office, 1981.

Figure IV. A. 4. c. - 2



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PROBABILTY OF CONTACT
▨ 0.5% - 10%
☐ <0.5%

SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for the cumulative case of the proposal with transportation scenario A and tankering of oil from Norton Sound.

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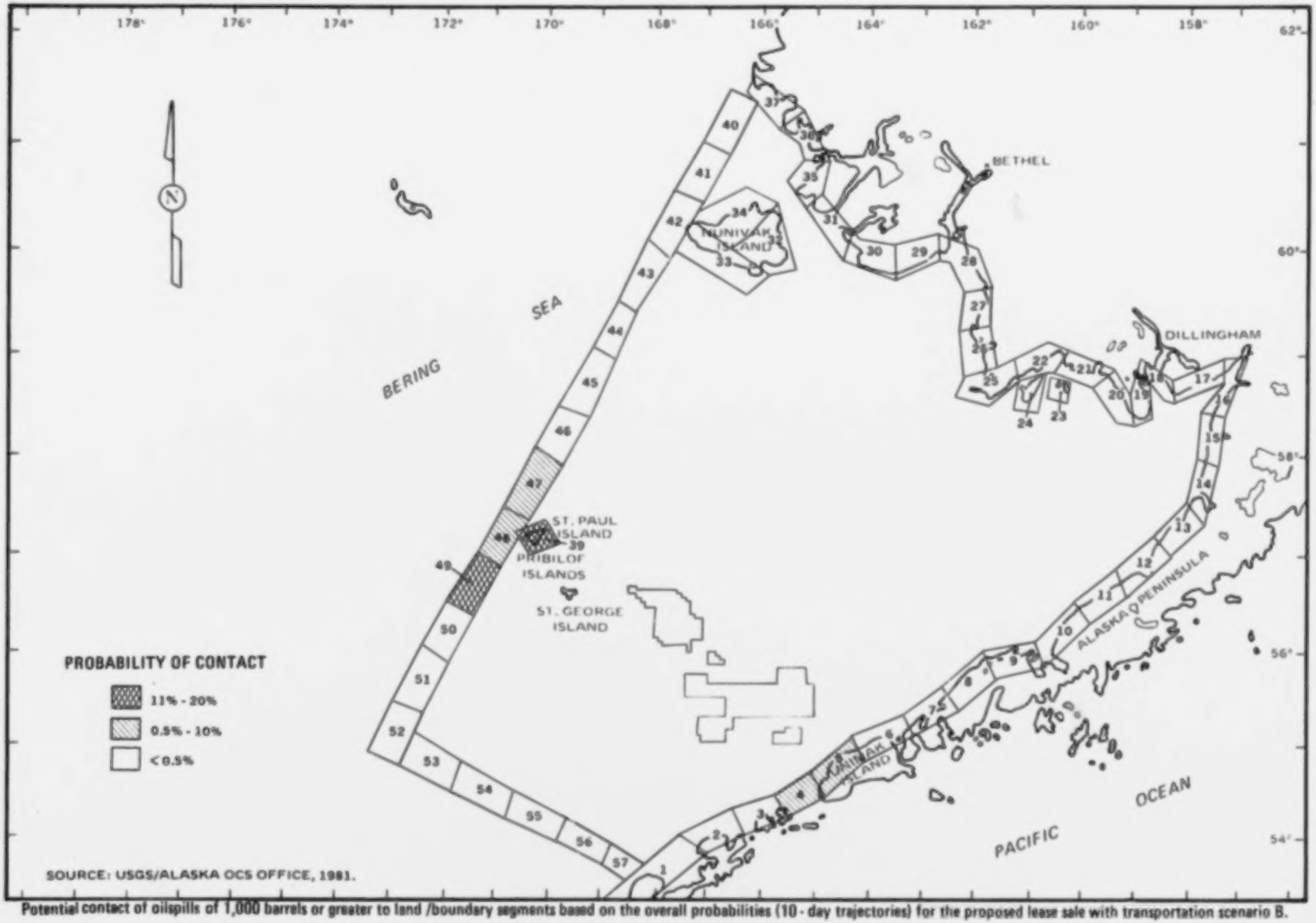
Figure IV. A. 4. c. - 3.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PROBABILITY OF CONTACT
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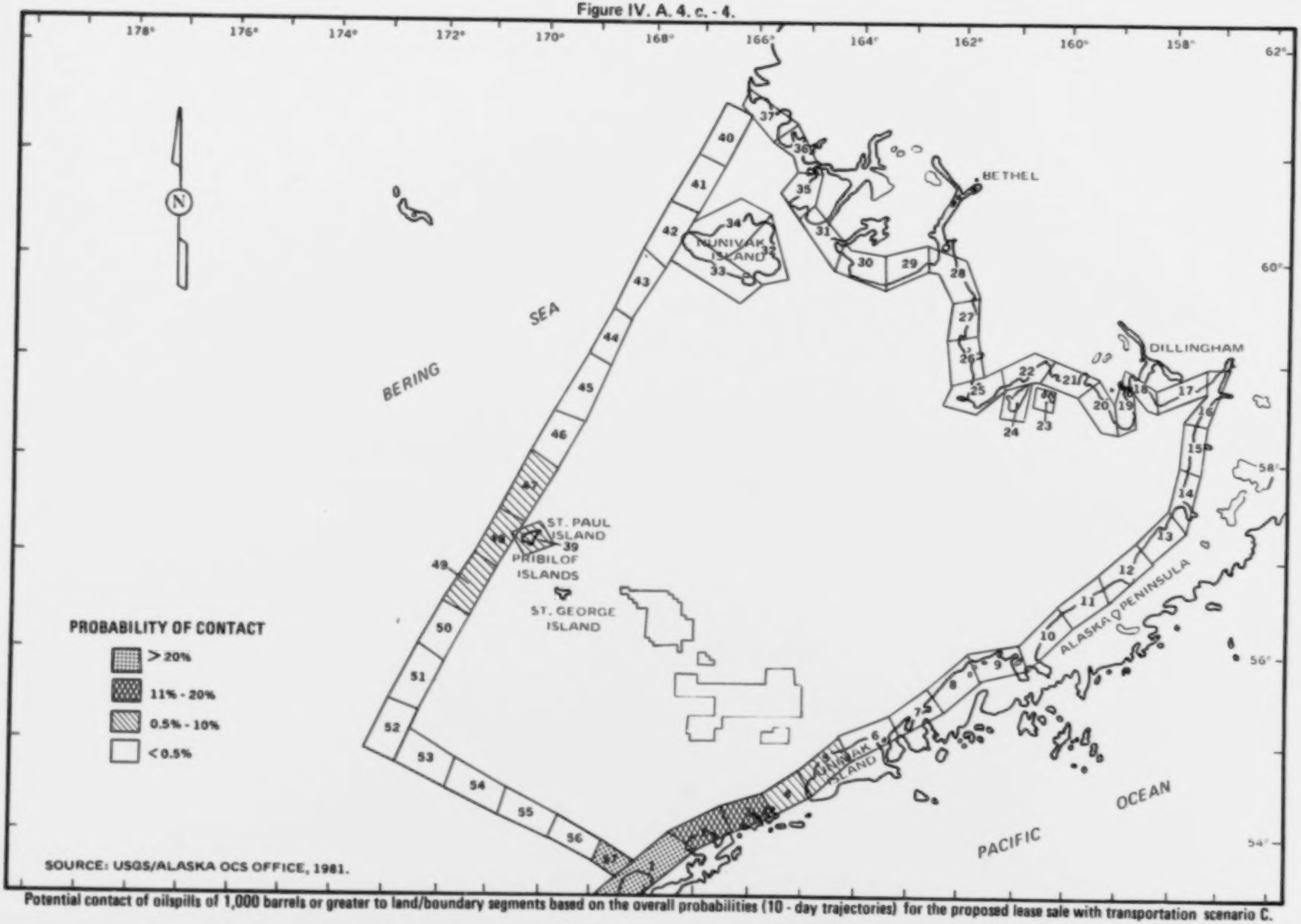
▨ 0.5% - 10%
☐ < 0.5%

SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land /boundary segments based on the overall probabilities (10 - day trajectories) for the proposed lease sale with transportation scenario B.

Figure IV. A. 4. c. - 4.



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PROBABILITY OF CONTACT
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SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for the proposed lease sale with transportation scenario C.

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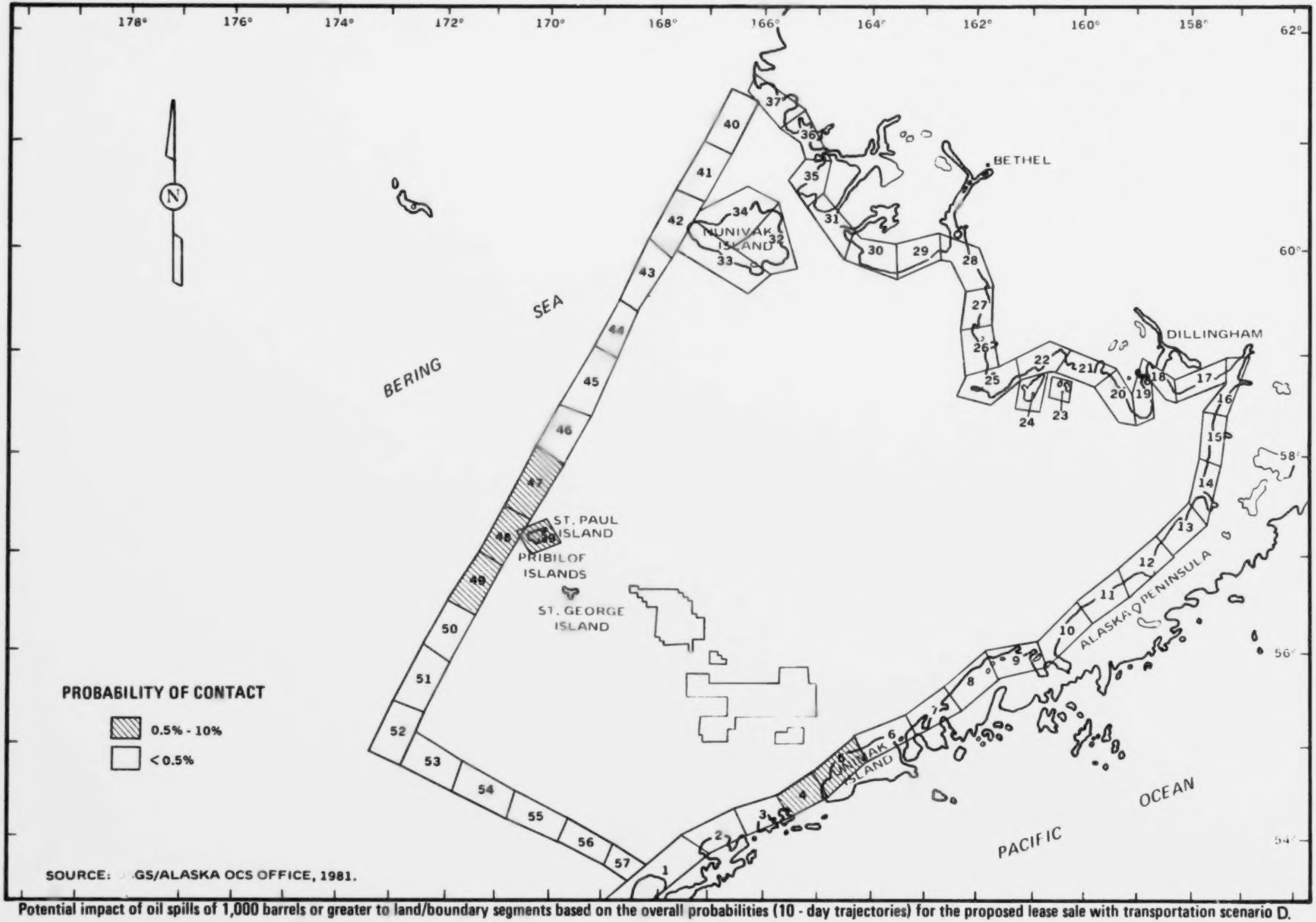
Figure IV. A. 4. c. - 5.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PROBABILITY OF CONTACT
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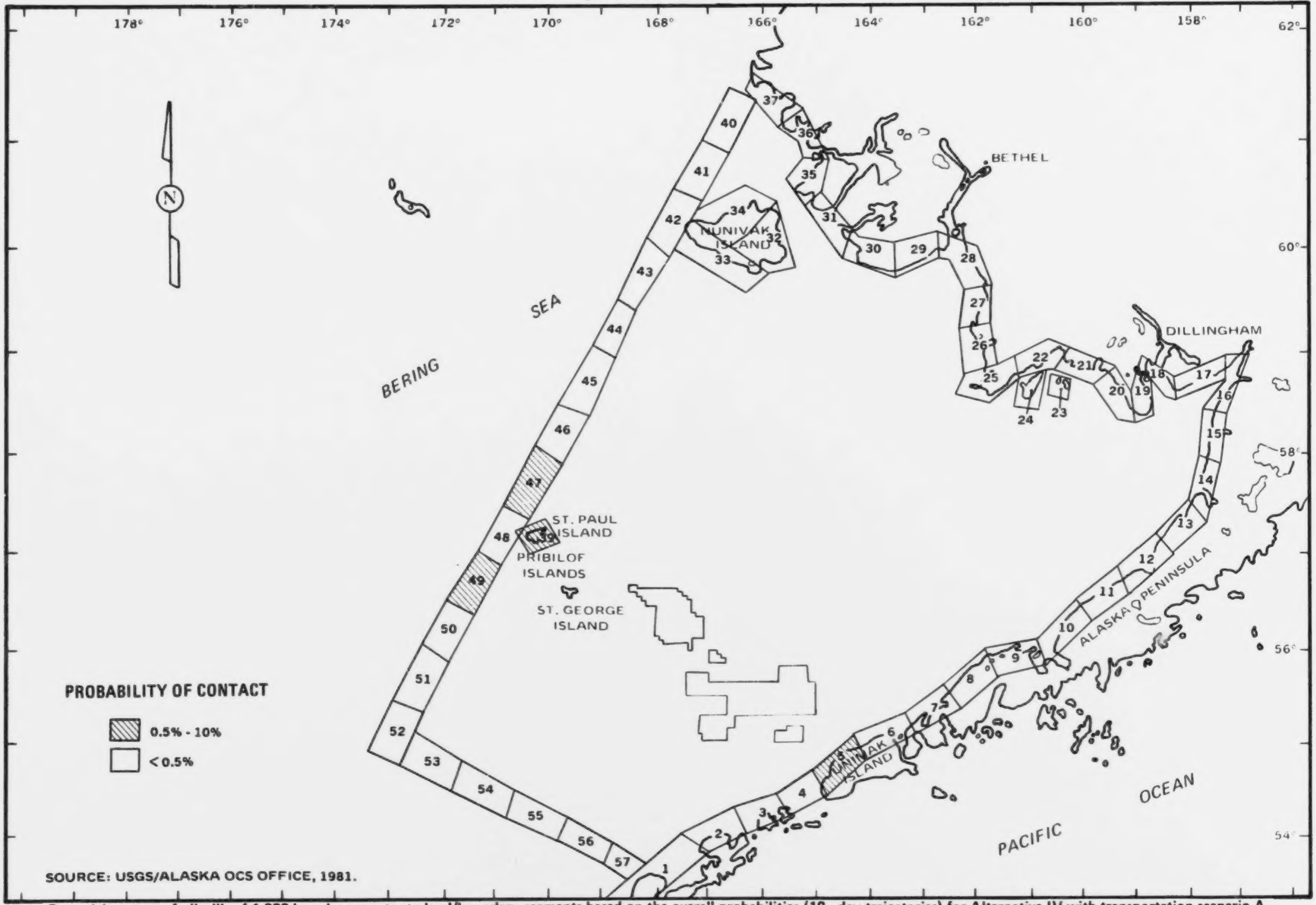
☐ < 0.5%

SOURCE: [illegible]GS/ALASKA OCS OFFICE, 1981.

Potential impact of oil spills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for the proposed lease sale with transportation scenario D.

Figure IV. A. 4. c. - 6.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SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for Alternative IV with transportation scenario A.

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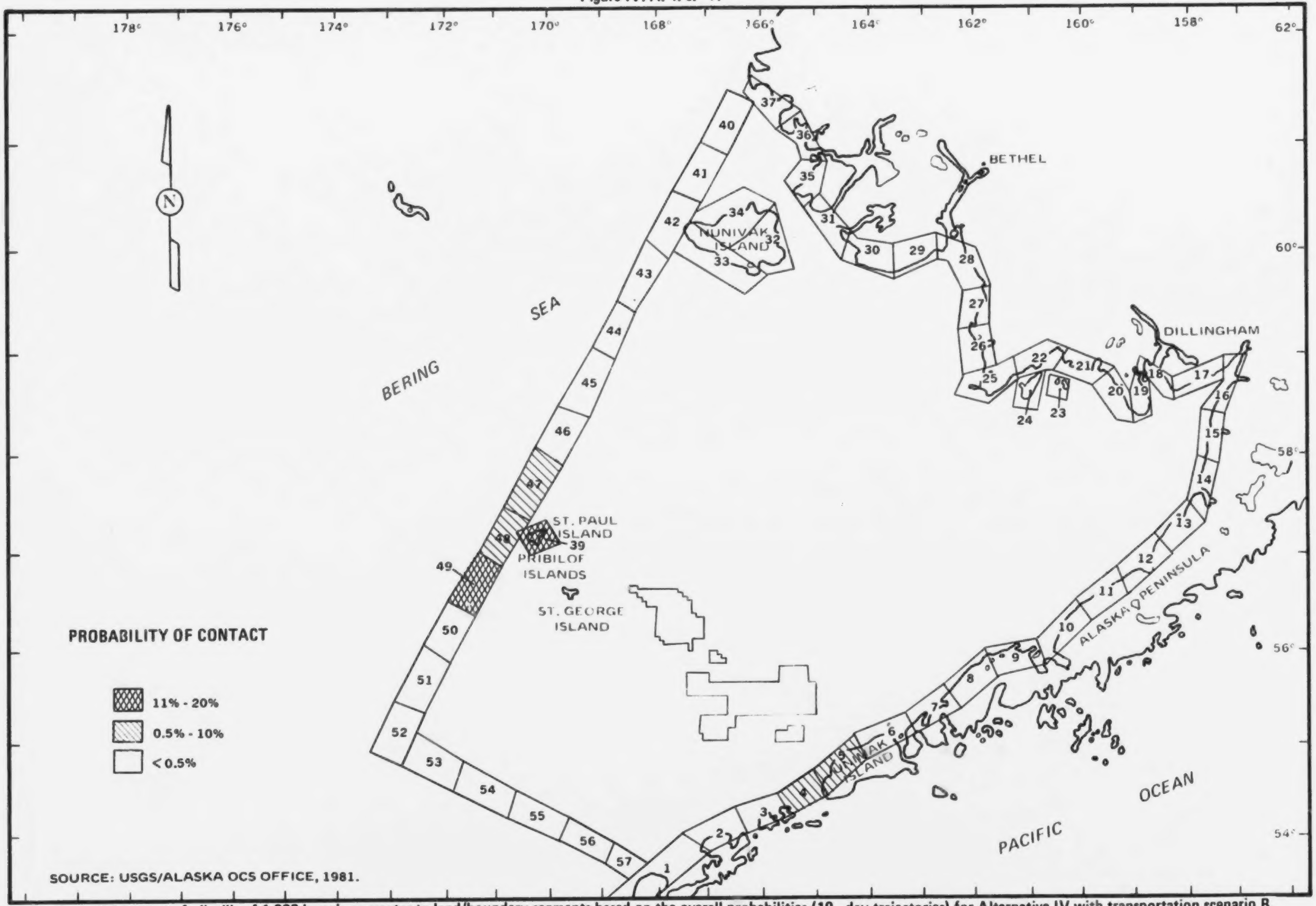
Figure IV. A. 4. c. - 7.



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PROBABILITY OF CONTACT
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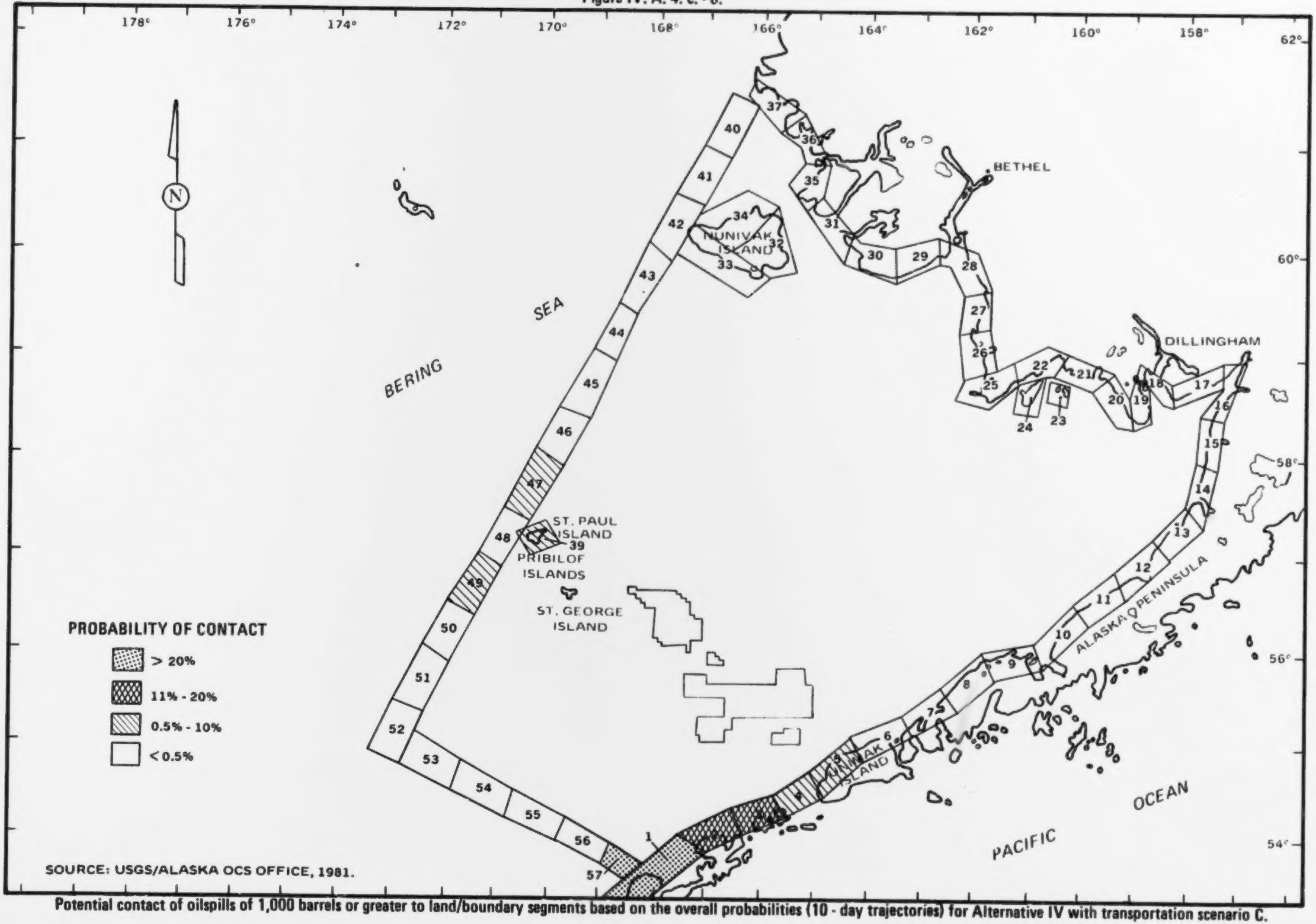
▨ 0.5% - 10%
☐ < 0.5%

SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for Alternative IV with transportation scenario B.

Figure IV. A. 4. c. - 8.



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PROBABILITY OF CONTACT
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SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for Alternative IV with transportation scenario C.

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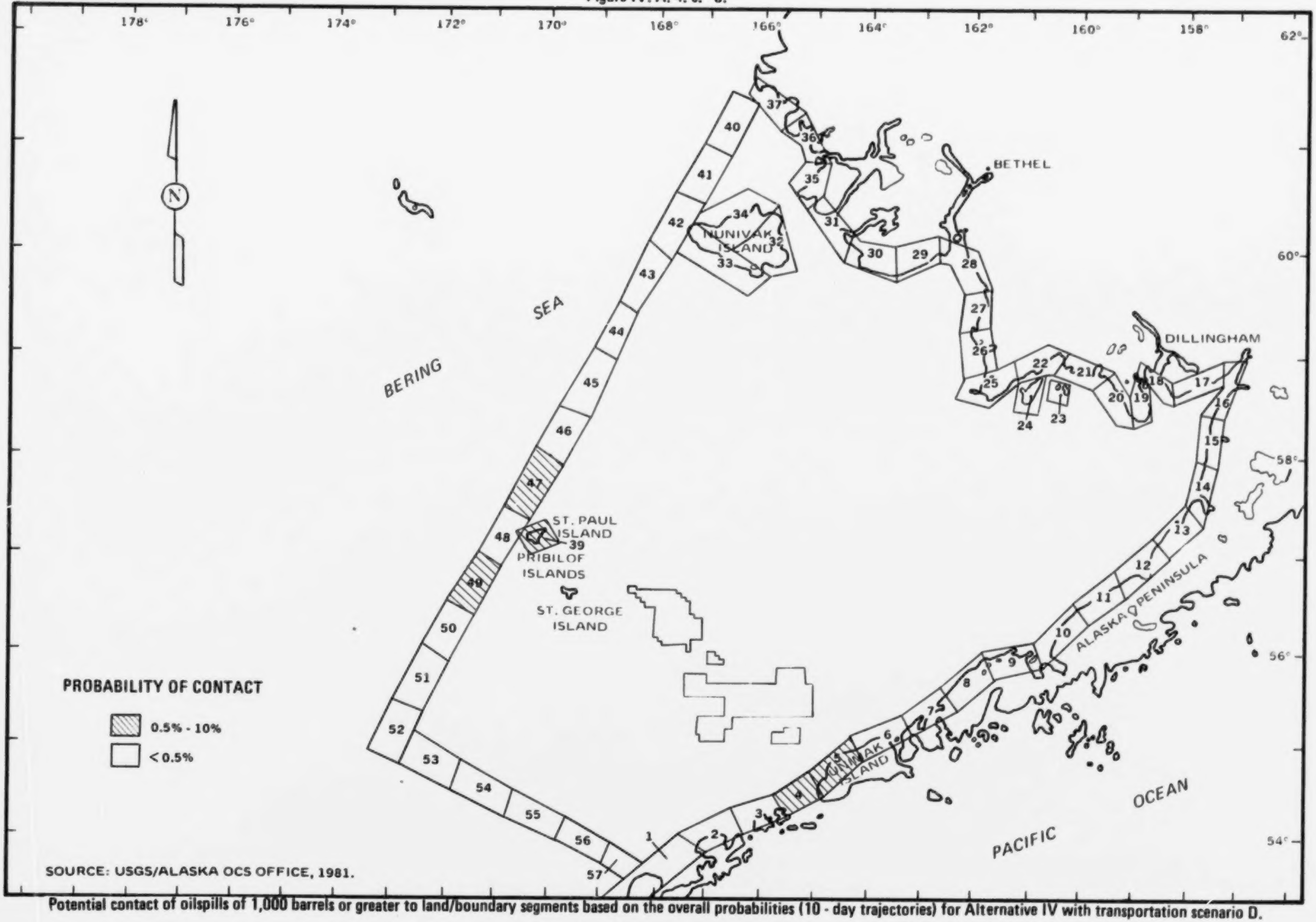
Figure IV. A. 4. c. - 9.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PROBABILITY OF CONTACT
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SOURCE: USGS/ALASKA OCS OFFICE, 1981.

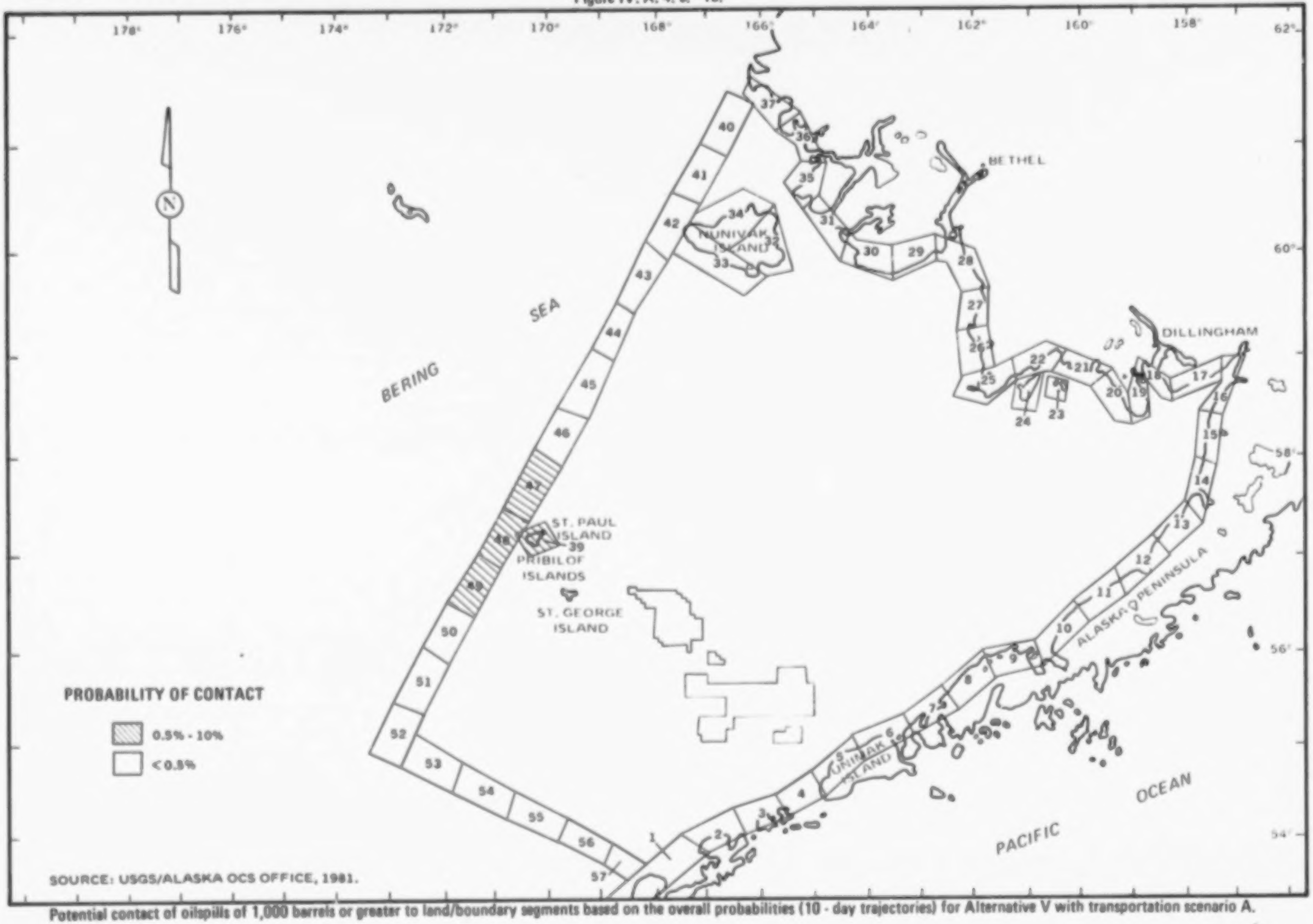
Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for Alternative IV with transportation scenario D.

Alternative V, the Unimak deletion, is partially effective in reducing oilspill risk to land. Transportation Scenario A has a slight reduction in overall risk over 10 days relative to that in the proposal, due almost entirely to elimination of risk to Unimak Island (Fig. IV.A.4.c.-10). Transportation Scenario B risk to land from 1,000 barrels or greater oilspills is reduced by 10 percentage points and Scenario C by 20 percentage points over that of the same scenarios in the proposal (Figs. IV.A.4.c.-11 and -12). The greater decrease for Scenario C is attributable to decreased risk to the northern side of the Aleutian Islands. However, oilspill risk to land with Scenarios B or C in Alternative V is still much higher than that for land in Scenario A for either alternative or proposal. The risk to land with Scenario D in Alternative V is similar to that of the same scenario in the proposal (Fig. IV.A.4.c.-13) and is close to that of Scenario A in Alternative V. The additional risk posed by tankering of Norton Sound oil through the proposed sale 70 lease area is still small relative to the risk posed by Alternative V with any of the four postulated transportation scenarios.

Alternative VI, the combined Pribilof/Unimak deletion, is the most effective deletion alternative in reducing oilspill risk. However, for transportation Scenario A, the 10-day risk to land following a 1,000 barrel or greater oilspill is reduced only from 12 percent in the proposal to 6 percent. As found in Alternative V, risk to the northern side of the Aleutian Islands is eliminated for this transportation scenario (Fig. IV.A.4.c.-14). For Scenario B, the risk is reduced from 39 percent in the proposal to 22 percent in Alternative VI, mostly due to lower risk in the Pribilof Islands (Fig. IV.A.4.c.-15). For Scenario C, the risk is reduced from 57 to 29 percent, mostly due to lower risk to the Aleutian Islands (Fig. IV.A.4.c.-16). For Scenario D, the risk is reduced from 18 to 9 percent with slight reduction in risk to both Pribilof and Aleutian Islands (Fig. IV.A.4.c.-17). Of (Scenarios B through D), the three alternative transportation scenarios in the deletion alternatives, only Scenario D in Alternative VI has lower oilspill risk to land than the proposal with Scenario A. For the cumulative case of Alternative VI plus tankering of Norton Sound oil, most of risk is still derived from proposed sale 70 lease area for all postulated transportation scenarios. Risk from Norton Sound tankering is negligible.

In summary, in the Oilspill Trajectories Simulations, the proposed action would have a very unlikely to likely chance (12-57%), depending on the transportation scenario, of causing an oilspill of 1,000 barrels or greater to contact land within 10 days. Transportation Scenarios A (pipeline to south side of the Aleutian Islands or Alaska Peninsula) and D (offshore loading) have comparable, low risk to land. Transportation Scenarios B (St. Paul Island terminal) and C (Makushin Bay terminal) have much higher risk. Based on this analysis, careful choice of transportation routes and mode could do more to lessen potential contact with oilspills than proposed block deletions. The locations most at risk by potential oilspills are the Pribilof Islands and the north side of the Aleutian Islands. With the exception of transportation Scenario C in the proposal and Alternative IV, it is unlikely that an oilspill would contact either location within 10 days. None of the deletion alternatives more than halve the probability that spills would reach land. A comprehensive contingency plan for sensitive areas of the Aleutian or Pribilof Islands might reduce risk of oilspill contact to the same extent any of the block deletion alternatives.

Figure IV. A. 4. c. - 10.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PROBABILITY OF CONTACT
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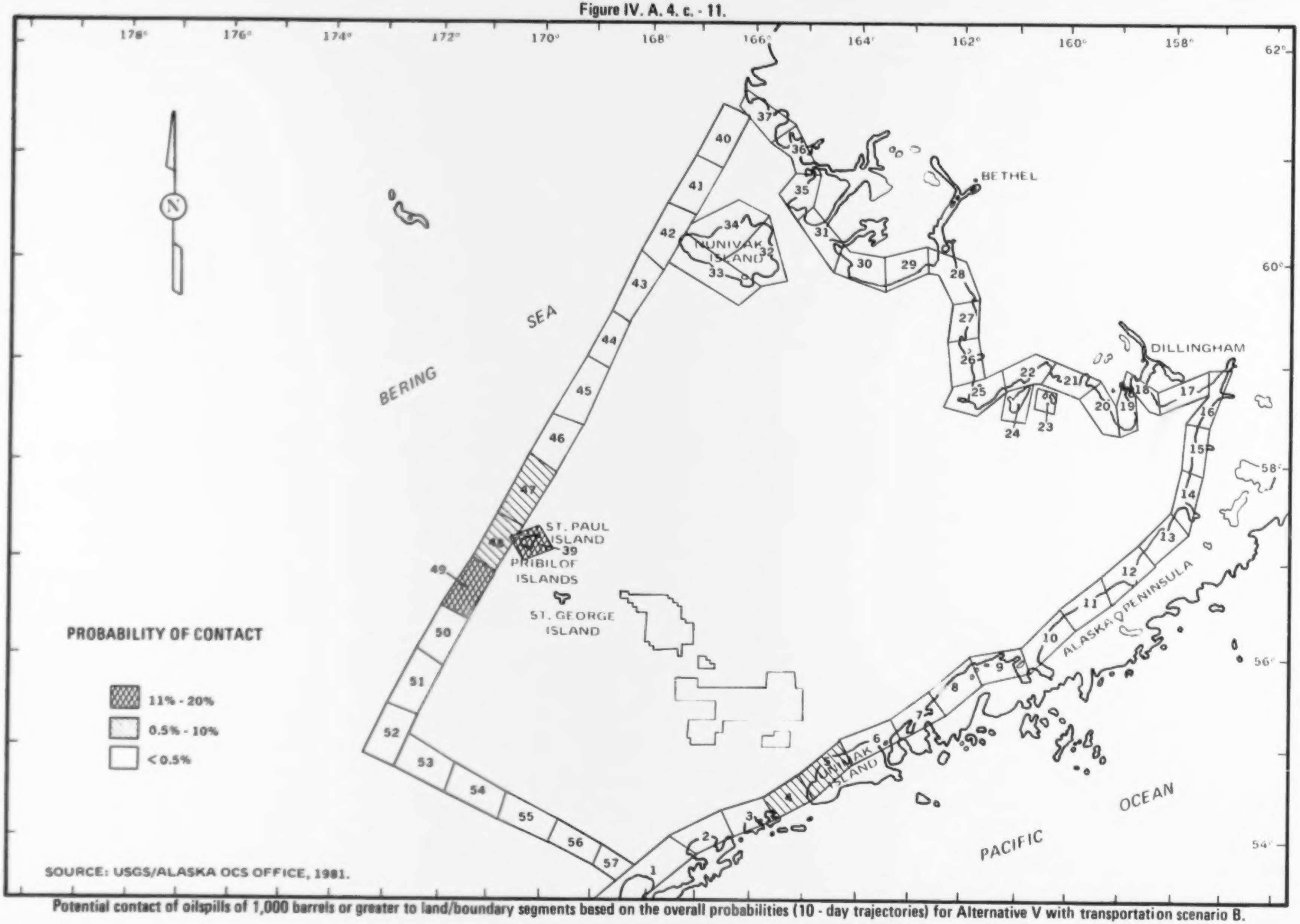
☐ < 0.5%

SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for Alternative V with transportation scenario A.

Figure IV. A. 4. c. - 11.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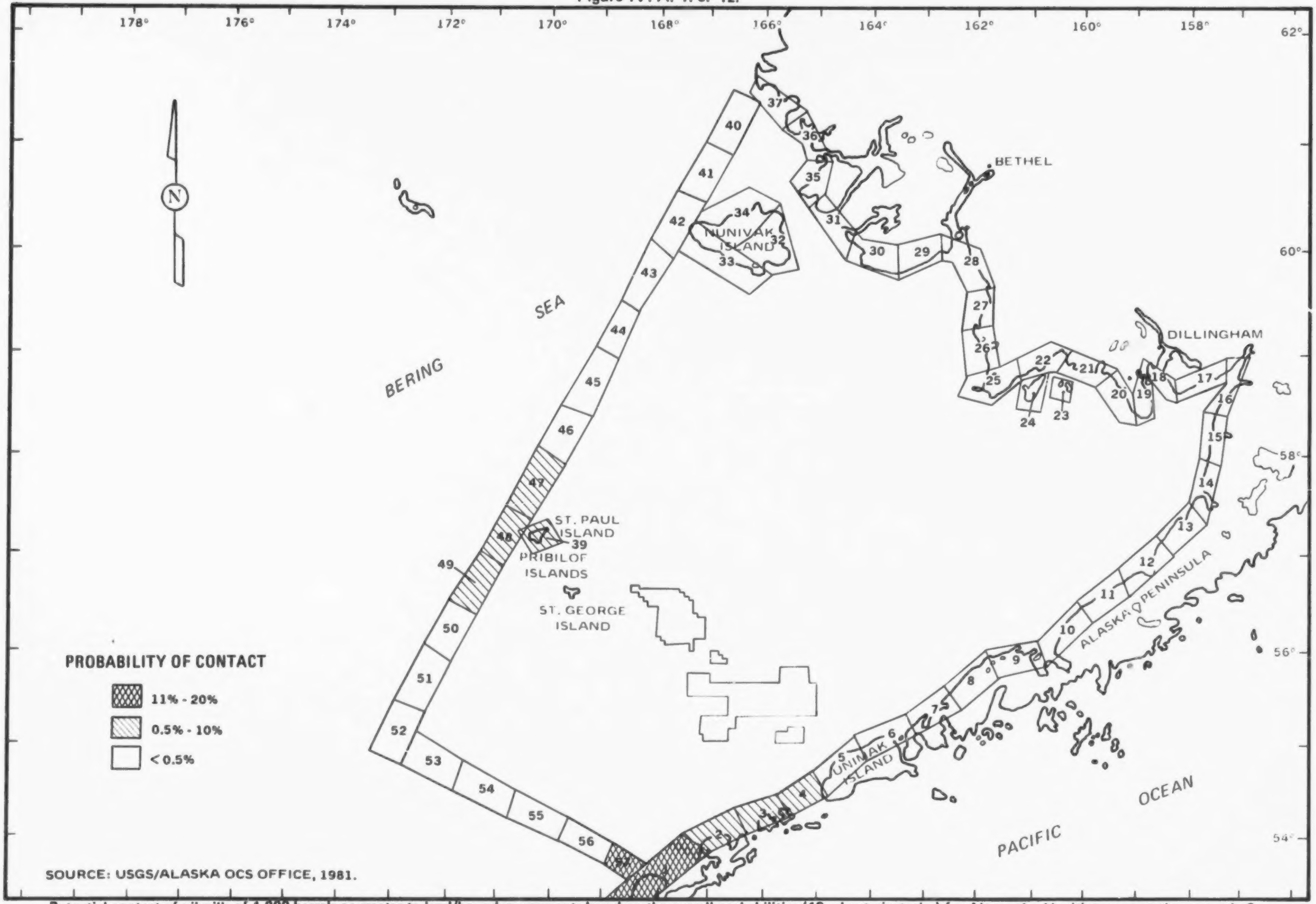
SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for Alternative V with transportation scenario B.

Figure IV. A. 4. c.- 12.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PROBABILITY OF CONTACT
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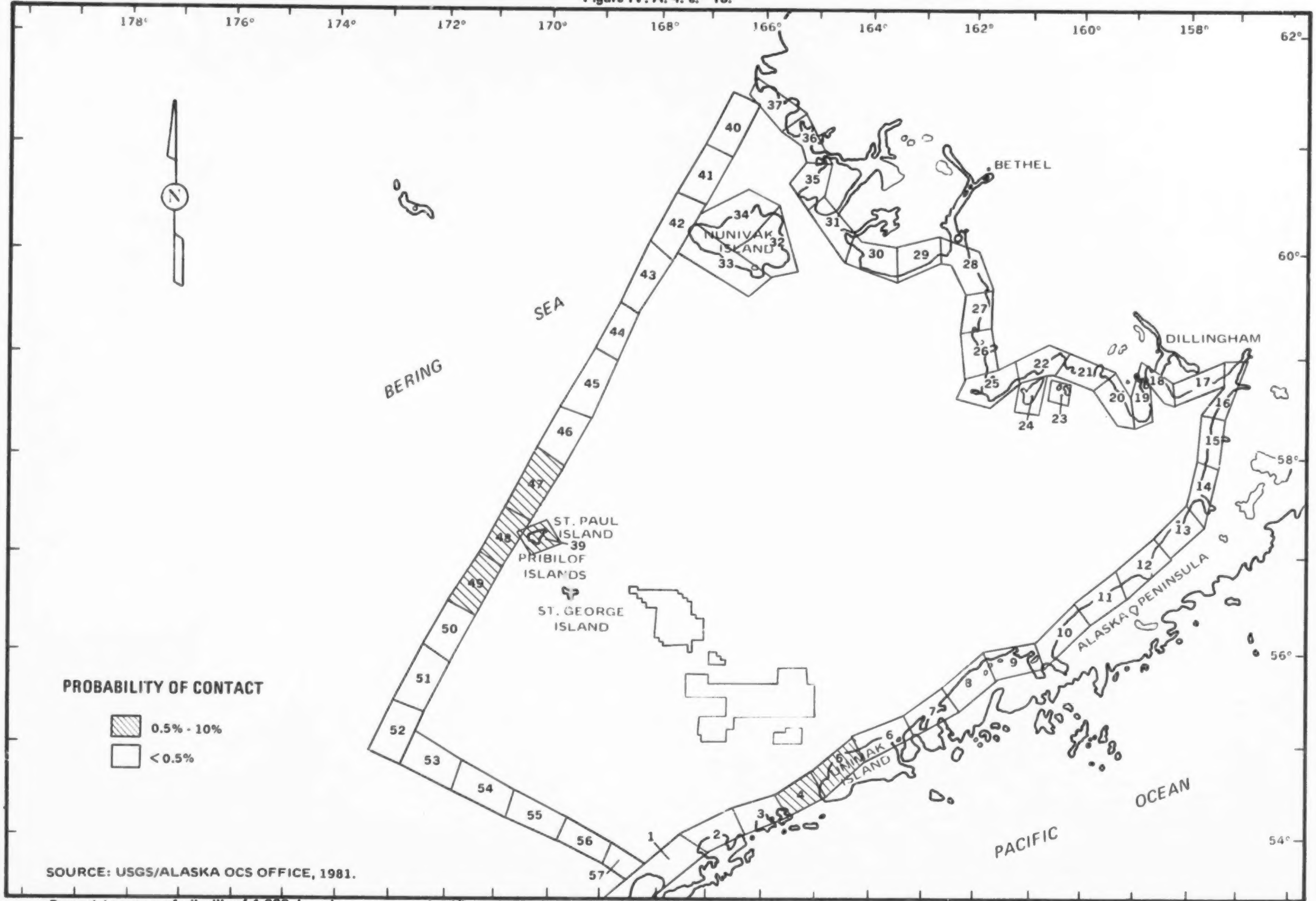
SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for Alternative V with transportation scenaria C.

Figure IV. A. 4. c. - 13.



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PROBABILITY OF CONTACT

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SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for Alternative V with transportation scenario D.

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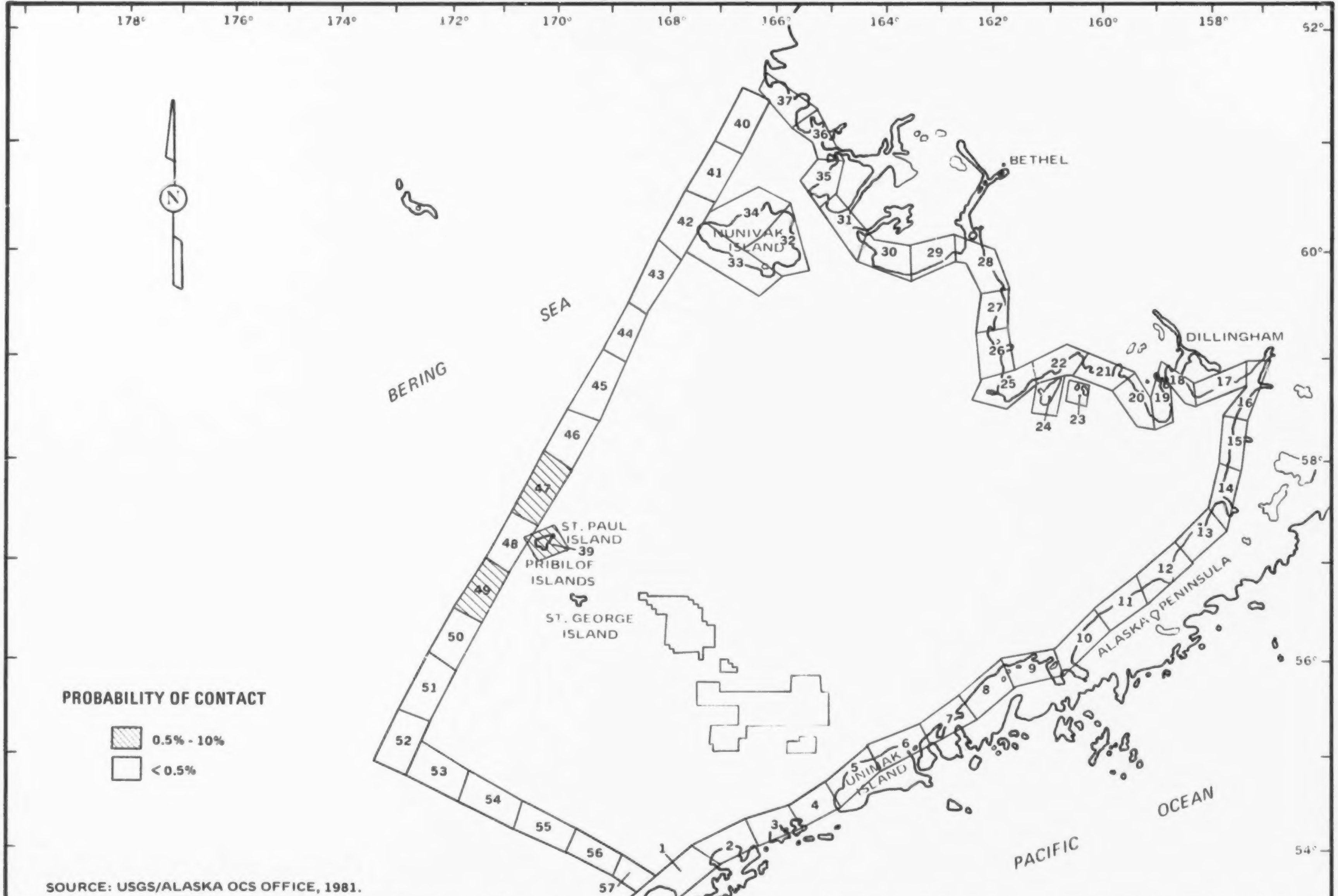
Figure IV. A. 4. c. - 14.



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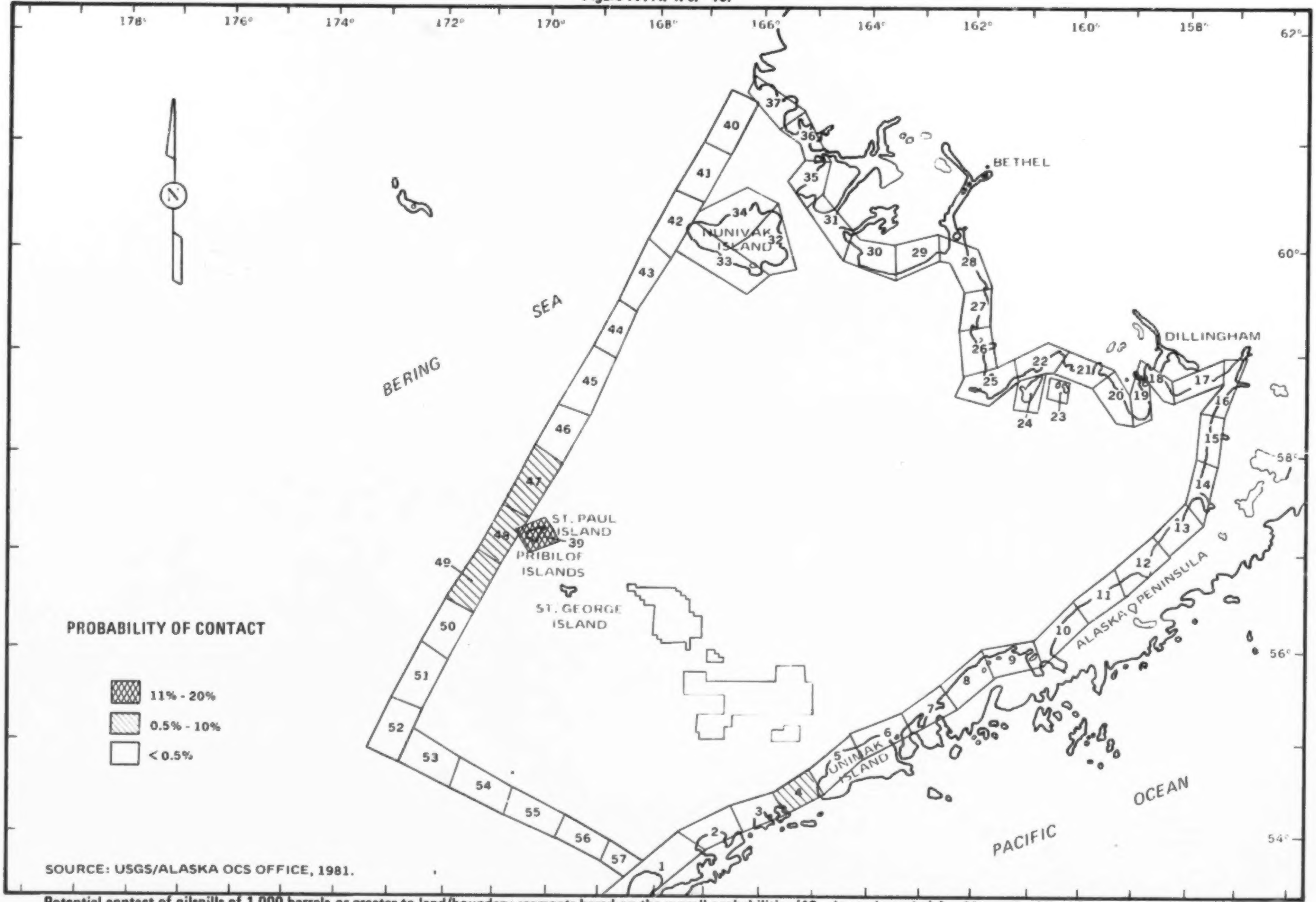
SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for Alternative VI with transportation scenario A.

Figure IV. A. 4. c. - 15.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PROBABILITY OF CONTACT
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SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for Alternative VI with transportation scenario B.

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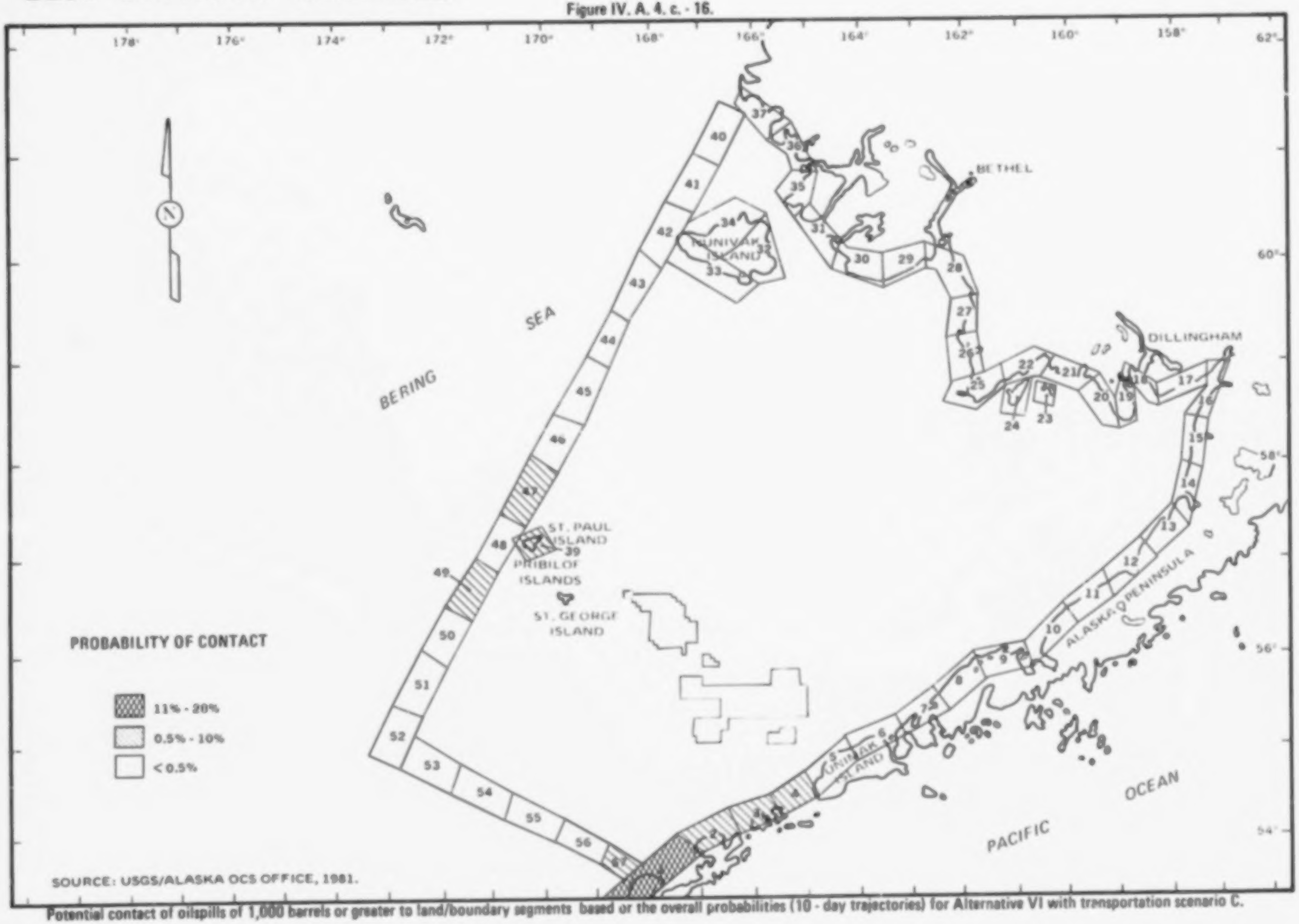
Figure IV. A. 4. c. - 16.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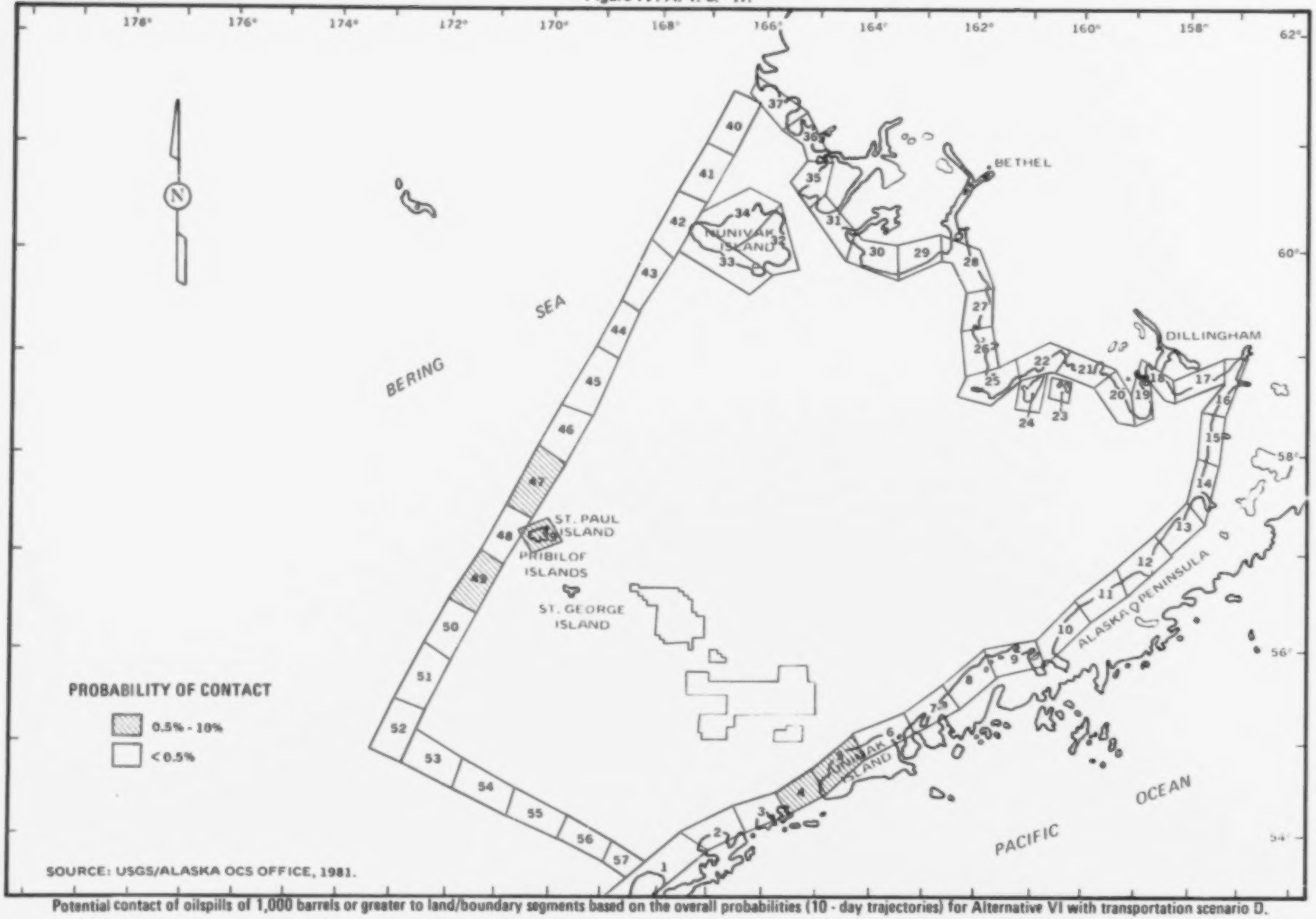
SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based or the overall probabilities (10 - day trajectories) for Alternative VI with transportation scenario C.

Figure IV. A. 4. c. - 17.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SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Potential contact of oilspills of 1,000 barrels or greater to land/boundary segments based on the overall probabilities (10 - day trajectories) for Alternative VI with transportation scenario D.

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5. Oilspill Response: Federal response capabilities and responsibilities in the event of an oil pollution incident are prescribed by the National Oil and Hazardous Substances Pollution Contingency Plan, published March 19, 1980, by the Council on Environmental Quality. The National Plan provides the framework for a geographically integrated Federal response capability, and encourages the participation of state and local governments in coordinated preparedness and action. The National Response Team serves as the model for regional response organizations, makes special forces and equipment available to regional organizations, and serves in an oversight capacity to evaluate and recommend improvements for response capabilities nationally.

In Alaska, the entire coastal area is a geographic zone of responsibility covered by the Alaska Coastal Region Multi-Agency Oil and Hazardous Substances Pollution Contingency Plan. The plan specifies responsibilities among Federal and state government agencies, and designates the primary responsibility for effecting a coordinated response to pollution incidents in the marine environment with the United States Coast Guard. In Alaska, as elsewhere in the nation, primary responsibilities for coastal and inland waters are divided between the Coast Guard and the Environmental Protection Agency (EPA), with the EPA assuming primary responsibility in those geographic areas upstream of tidal influence.

The Alaska Coastal Region Plan specifies governmental response to a pollution incident as primarily a function of the Regional Response Team (RRT), the On Scene Coordinator and the Scientific Support Coordinator. The RRT is composed of Federal and state agency representatives and is chaired jointly by the Coast Guard and EPA. The RRT is responsible for planning and preparedness actions prior to a pollution discharge and for coordination and advice during a pollution emergency. In addition to the Coast Guard, members of the Alaska Coastal RRT are designated representatives from the State of Alaska, the EPA, the Federal Emergency Management Agency, and the following Federal departments: Agriculture, Commerce, Defense, Energy, Health and Human Services, Interior, Justice, Labor, and State. Representatives of local governments may be designated to participate in the activities of the RRT. And, as at the national level, the Coast Guard additionally maintains and operates the Regional Response Center, which in Alaska, is located at the District Headquarters in Juneau.

Alaska coastal waters are divided into geographic zones of responsibility for which an On Scene Coordinator (OSC) is predesignated by the Coast Guard. The designated OSC for the lease sale area is the Commanding Officer, Marine Safety Office, Anchorage. The function of the OSC is to develop and maintain a Federal local contingency plan for Federal response in the area of the OSC's responsibility; and, at the scene of a discharge, to serve as the single point of contact for advising the spiller on cleanup measures or, if necessary, to coordinate and direct the Federal response and expedite pollutant removal efforts. The OSC provides information to and receives advice from the RRT during a spill emergency. The Scientific Support Coordinator (SSC), provided by the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce, is on the staff of the OSC at the scene of a spill to provide scientific advice and mediate advice from the scientific community on the scene.

The following is available to assist the RRT, OSC, and SSC in performing their duties: national special forces on call such as the Pacific Strike Team of the Coast Guard and the Environmental Response Team established by the EPA; a computerized national inventory of pollution response and support equipment for locating specialized equipment tailored to the characteristics of the spill; memoranda of agreement and interagency agreements to explicitly define areas of responsibility in cases where ambiguity may exist; and, specialized functional groups within the RRT to provide expertise and leadership in areas such as public information, pollution control techniques, damage assessment, and protection of living marine resources.

a. Petroleum Industry Oilspill Response Organization: An oilspill response organization is expected to be organized by the petroleum industry prior to exploration in the proposed lease sale area, as has been the case elsewhere in Alaska. The existing petroleum industry response organizations include the Cook Inlet Response Organization, the Gulf of Alaska Cleanup Organization, and the Alaska Beaufort Sea Oilspill Response Body. These response organizations are made up of a number of petroleum industry companies and operate through voluntary private industry agreement to jointly acquire oilspill containment and cleanup equipment, train personnel in its deployment and use, and provide a pooled capability of response greater than any individual company could provide.

b. Petroleum Industry Oilspill Contingency Planning: The petroleum industry oilspill response organization in the proposed lease sale area can be expected to produce and continue to maintain an oilspill contingency plan, which is a compilation of information needed by on-site response personnel. Such information generally includes inventories and operating characteristics of equipment resources; lists of supplies and distributors of containment and cleanup services and supplies; procedures for containment, cleanup, and disposal; the names and telephone numbers of specific individuals in key government and business organizations; and, organizational policy and operating agreements with other firms.

Additionally, the industry response organization in the proposed sale area is expected to belong to the Alaska Cooperative Oilspill Response Planning Committee (ACORP), an informal organization formed in 1977 that includes the Alaska Department of Environmental Conservation, the United States Coast Guard, and the petroleum industry in Alaska. The ACORP Pollution Response Plan is intended to provide the means to coordinate Federal, state, and petroleum industry resources in response to a significant oil pollution incident in coastal waters of Alaska. The plan provides for the sharing of resources, including equipment and technical expertise, among public and private spill response organizations, and specifies procedural and fiscal terms and conditions for such sharing. Besides facilitating cooperative oilspill response, the plan allows the responsible party in a spill incident to gain access to state, Federal, and industry oilspill and logistics equipment, technology, and personnel.

c. Oilspill Preparedness by OCS Lessees: The revised outer continental shelf orders governing oil and gas lease operations (Federal Register, December 21, 1979) specify requirements of OCS lessees for oilspill preparedness. OCS Order No. 2 (drilling operations) requires the lessee to submit with the Exploration Plan or Development and Production Plan to the

Deputy Conservation Manager (DCM), USGS, evidence of the fitness of the drilling unit to perform the planned drilling operation. Such evidence must also include information on pollution prevention equipment associated with the drilling operation. Based on past experience, minimum equipment and supplies for initial containment are based at the drilling site, usually including an inflatable containment boom, a mechanical oil skimming device, a storage container for cleaned up oil, sorbent pads, surface collecting and dispersant chemicals as well as chemical applicators. Generally, the operational capabilities of the containment booms found on board (based on manufacture type), function in waves up to 5 to 6 feet and in winds of up to 20 to 25 knots. Oil skimming equipment of the type generally on board operates in waves up to 2 to 3 feet in height, whereas sorbent booms and pads are used only with contained spills.

OCS Order No. 7 prescribes measures required of each lessee for pollution prevention and control. Included are requirements for inspections and reports, pollution control equipment and materials, oilspill contingency plans, as well as annual drills and training of personnel. Oilspill contingency plans are required of each lessee, submitted for approval to the DCM with, or prior to, an Exploration Plan or a Development and Production Plan. Required in the contingency plans are information on response equipment and deployment times, response capability for varying spill severity, the means for identifying and protecting areas of special biological sensitivity, procedures for notifying key personnel, and provisions for response action at the scene of a spill. Pollution control equipment and materials are required to be maintained by, or available to, each lessee at an offshore location, or at a location approved by the DCM. Availability of such equipment and materials is required prior to the commencement of drilling and production operations. For example, in the case of OCS sale 39, exploratory drilling off Yakutat, pollution control equipment and materials were located in Yakutat and Seward, as well as the drilling vessel itself.

d. Cleanup Policies and Techniques: According to the Alaska Coastal Region Plan, the primary consideration in any spill response is the protection of life and property, followed by protection of the natural environment. Endangered and threatened species identified by Federal law are also specifically addressed in the new National Plan. Where total removal of the pollutant from the environment is not possible, action to protect critical areas and remove pollutants therefrom takes priority.

Mechanical methods and sorbents are preferred in Alaskan waters for control of the source of discharge as well as the containment and removal of the pollutant. The use of chemical agents is governed by the National Plan and the circumstances of the spill. Generally, approval for use of chemical agents must be obtained from the senior EPA representative on scene at the spill on a case-by-case basis, after consultation with other appropriate state and Federal representatives. Exceptions to this general rule are for the use of surface collecting agents in accordance with the National Plan listing of approved chemicals where the use of chemicals would reduce the immediate hazards to human life due to explosion and fire.

e. Oilspill Incident Response: The Federal Water Pollution Control Act requires that all harmful discharges of oil and all discharges of hazardous substances into the navigable waters of the United States must be reported immediately to the appropriate Federal authority. The designated authority in Alaskan coastal waters is the United States Coast Guard. The Coast Guard can be contacted as follows:

(1) Calling the toll free number ZENITH 5555.
(2) Calling the designated OSC for the area in question. In the case of the proposed lease sale area, the OSC is Captain R. H. Spoltman, 907-271-5137.
(3) Calling any Coast Guard unit in the vicinity of the incident.
(4) Calling the Commander, 17th Coast Guard District in Juneau, 907-586-7195.

The OSC has the responsibility to respond to all reports of spill incidents. Oilspills in coastal waters are classified according to the National Contingency Plan by the amount or potential amount of discharge, as follows:

Minor discharge:	less than 10,000 gallons.
Medium discharge:	10,000 to 100,000 gallons.
Major discharge:	more than 100,000 gallons.

The report of the existence or potential of a major spill, even an unconfirmed report, requires the OSC to immediately notify the National and Regional Response Centers. A minor spill normally will not require the OSC to alert the full membership of the RRT, but the decision to do so is based on the judgment of the OSC after investigating the spill report. Alerting the membership of the RRT usually is carried out by telephone conference call and normally is cause for activating the full or partial membership of the team to the scene of discharge.

Federal policy strongly encourages those responsible for a spill to take appropriate abatement and cleanup actions voluntarily. When the responsible spiller takes appropriate actions, the OSC will observe and monitor progress and provide advice and counsel to the spiller. Federal cleanup activities are instituted when the spiller is unknown, or in the judgment of the OSC, the spiller does not act promptly, does not initiate appropriate cleanup action, or is unable to take adequate cleanup measures.

If an alleged spiller can be identified and cleanup is required, the OSC must immediately notify the owner, operator, or appropriate responsible party, in writing, of Federal interest, liability for cleanup, and other aspects of the Federal Water Pollution Control Act or National Contingency Plan, as appropriate. If the alleged spiller fails to initiate cleanup activities, or initiates improper or inadequate cleanup actions, the OSC must advise the spiller in writing that his actions are considered inadequate and that he is liable for cleanup costs incurred in the event of a Federal cleanup. Such notice failing, the spill incident becomes a Federal responsibility.

6. Constraints on Oil and Gas Development: The purpose of this section is to describe the potential severity of the more significant natural hazards to onshore and offshore oil and gas development in the St. George Basin.

a. Earthquakes and Related Hazards: The participants of the 1981 sale 70 synthesis meeting considered earthquakes a greater threat to facilities located on the Alaska Peninsula and the eastern Aleutian Islands than to offshore facilities within the proposed sale area. Although the likelihood of a high magnitude event (5.5 or greater) within the next 40 years is great for the St. George Basin, OCS Environmental Assessment Program (OCSEAP) seismologists believe a more serious threat exists in the vicinity of the Shumagin Islands. The probability is extremely high that within the next 20 years a great earthquake (magnitude 8.5 or greater) will occur within this segment of the Aleutian Arc. The related hazards triggered by the event would place considerable constraint on the siting and design criteria of any oil and gas facilities, especially along the southeast shoreline. The long-period ground shaking would be severe within 100 kilometers (62 mi) and a tsunami with a height up to 30 meters could be generated which would hit the southeast shoreline.

Offshore, much of the hazard to exploration and development facilities could be mitigated by strict adherence to USGS OCS Operating Orders especially Orders 2 and 8. A description of these orders and other Federal regulations that apply to OCS oil and gas development can be found in Alaska OCS Technical Paper No. 4 (Casey, 1981).

Onshore and in shallow water areas near the coastline may not be feasible to design fully disaster-proof facilities due to the very limited selection of potential sites within a highly seismic active area. However, there are some steps that would decrease some of the risk. The high degree of risk associated with earthquakes and the hazards they trigger should be considered when the design, location, and type of infrastructure network and the design and location of buildings is considered. Possible target areas for tsunamis should be avoided if possible. If that is not possible, engineering protective measures, such as breakwaters and coastal dikes, could be undertaken to weaken any potential tsunami (UNESCO, 1976).

b. Volcanoes: The Alaska Peninsula/Eastern Aleutian Island Arc is one of the most volcanically active areas in the world. Many of the volcanoes have been active during historic times and the likelihood of eruption within the next few decades is high. They are andesitic in nature and generally are the explosive type. Usually the major threat from this type of eruption is the direct blast. However, other potential hazards that are related, such as glowing avalanches, mud flows, floods, lava flows, bomb and ash fallout, tsunami, and seiches, can also be destructive.

The direction and path of flow of many of the hazards named above are controlled by topography. Any facilities located in valleys and low-lying areas that could serve as channels for volcanic material would be threatened (Warrick, 1975).

Bombs and ash falls place only minor constraints on potential oil and gas facilities. The fallout of bombs is usually restricted to short distances from the eruption. Volcanic ash poses more of a threat to personnel and exposed mechanical equipment due to its abrasive nature and its potential for covering larger areas.

Tsunami and seiches triggered by eruptions are a danger to facilities located along coastlines or in nearby embayments.

The 1883 eruption of Augustine Volcano generated a tsunami that traveled a distance of approximately 80 kilometers to English Bay and Port Graham in 25 minutes and attained a height of 10 to 12 meters (FEIS sale 60). Other instances in recorded history where volcanic activity as well as earthquakes have produced tsunami or seiches in Alaska can be found in Section III.A.1.c. of this EIS.

Much of the hazard from volcanic activity can be mitigated by: (1) selecting sites for facilities that are not in the potential flow paths of avalanches, mudflows, lava flows, and floods; (2) adequate prediction and warning systems; (3) monitoring and surveillance of individual volcanoes; and (4) selecting sites for facilities in areas that are potential targets for tsunami and seiches.

c. Faulting: Numerous faults, surface and near surface, have been identified and mapped within the St. George Basin area. However, at the present time, available data are insufficient to determine if they are active (OCSEAP, 1981).

Due to the potential for a blowout the presence of active faults could pose a moderate constraint on offshore drilling. Also, any movement along a fault that is the result of earthquake activity could be a serious threat to subsea completions and pipelines.

Constraints to drilling can be mitigated by USGS operating orders, especially Order No. 2 which addresses the requirements for shallow geologic hazards surveys and an analysis for each proposed drilling location in order to avoid such hazards as faults.

Threats to subsea completions and pipelines can be mitigated by choosing a route free of active faulting, or by designing a pipeline that would be flexible over active faults in order to accommodate shifts in the sea floor. A discussion of offshore pipeline safety practices can be found in a report prepared for the U.S. Department of Transportation by Funge et al. (1977).

d. Ice: Sea ice cover could be a serious hazard to offshore facilities during February through April of maximum ice years. During that period fixed structures would be subject to pack ice velocities up to 0.5 meter/second and to the oscillatory motion of broken ice near the ice edge. The latter would be most severe during a storm or during periods of large swells. It could result in oscillations in the structures due to ice impact.

Another potential hazard is the direct ice sheet accretion to offshore structures. This would alter the resonant frequency of the facilities (OCSEAP, 1981).

Ice thickness and flow velocity could pose a moderate to high hazard to tankers and offshore loading facilities.

Compliance with USGS operating orders, the USGS Platform Verification Program (PVP) and the USGS BAST Program would mitigate much of the ice threat to fixed structures. These requirements deal with the design criteria that is necessary to effectively mitigate the impact from the environmental hazards of the area. A description of the operating orders and the above mentioned programs

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can be found in Alaska OCS Technical Paper No. 4 (Casey, 1981). Another measure that could lessen the threat is the use of ice-breading support vessel to minimize the impact of the ice.

e. Unstable Sediments: Unstable sediments are not considered a hazard to facilities within the proposed lease area. However, they could be a serious threat to pipelines crossing the continental shelf slope and the walls of Pribilof Canyon and Bering Canyon.

This threat can be mitigated by: (1) compliance with the Department of Transportation's safety regulations for the transportation of gases and hazardous liquids by pipeline; and (2) by the Department of the Interior's responsibilities under the OCS Act which includes applying BAST to rights-of-ways and rights-of-use and easements for the construction of pipelines on the OCS.

f. Gas-Charged Sediments: At the present time there is not enough information to completely evaluate the hazards related to gas-charged sediments in the proposed sale area. Seismic profiles do indicate the presence of a number of anomalies at depths of 200 to 300 meters (656-984 ft) that could be the result of gas present in the sediments. However, this has never been confirmed by drilling. Also, small quantities of hydrocarbon gases are present in the surface and near-surface sediments. A limited examination does not indicate they are a hazard.

Gas-charged sediments can be a hazard to any drilling program due to their potential for blow-out. However, this threat can be mitigated by compliance with USGS Operating Order No. 2 which requires well-site surveys that will identify such hazards as shallow gas deposits.

Conclusion: Earthquakes and the related hazards they trigger have the potential of being the most significant threat to oil and gas facilities located onshore and in shallow waters. It is possible to decrease some of the risk by engineering design and selection of building sites in less hazardous zones. However, taking into consideration the potential destructive force of these events, it may not be possible to design fully disaster-proof facilities due to the limited selection of potential sites. The combined force of these hazards could result in substantial damage to pipelines and associated facilities. Offshore, within the proposed lease sale area, these hazards pose very little threat to fixed structures.

The threat from volcanoes and its related hazards is high to onshore facilities that are located close to active volcanoes or in topographic lows that could serve as channels for floods, mud flows, avalanches, and lava flows.

Sea ice can be a major threat to offshore loading terminals and tankers. The technology has not been developed to handle ice hazards for this type of offshore facility. However, the risk to other offshore fixed structures can be mitigated by compliance with USGS design criteria and by active ice defense using ice-breaking support vessels.

Unstable sediments, gas-charged sediments, and faulting are not considered major hazards to offshore platforms and pipelines. The risks associated with these hazards can be mitigated by methods described earlier in this section.

Effect of Additional Mitigating Measures: The potential mitigating measures described in Section II.B.1.c. are not applicable to this section.

Unavoidable Adverse Effects: The technology for offshore loading facilities in ice-covered areas is not available at the present time. However, taking into consideration the time that will be needed to reach the production phase, the engineering design needed to mitigate this risk could become available at a later time.

Codes and regulations for design and construction and siting restrictions can decrease the threat to onshore and near-shore oil and gas facilities. However, as mentioned in the conclusion, it may not be feasible to mitigate all the risk. Due to the potential destructive force of the hazards to onshore and shallow water facilities and the poor selection of potential sites it may not be feasible to design a fully disaster proof infrastructure.

7. Major Projects Considered in Cumulative Impact Assessment:

a. Guidance on Cumulative Impact Assessment: There are two fundamental issues in cumulative impact assessment: identifying other actions which may contribute to significant cumulative impacts, and identifying methods for measuring and evaluating cumulative impacts in this EIS. This section addresses primarily the first issue. The second issue is discussed under each assessment. The two issues are interrelated in that a determination must be made whether another action or project is sufficiently defined and its impacts understood so that a meaningful cumulative effects assessment can be completed.

Specific factors for determining whether future actions should be the subject of cumulative impact assessments include the following: (a) whether the proposal includes a submittal and completed application for a license, permit, or other regulatory approval; (b) whether the proposal has been determined to be a "project which may significantly affect the environment" under NEPA; (c) whether the proposal is sufficiently defined in terms of construction and operational characteristics to derive potential impacts in the absence of any formal NEPA review; (d) whether the proposal's geographic area of influence is contiguous to or overlapping with the region that is the subject of environmental assessment in this proposal; (e) whether there is a substantial commitment to execute the proposal; and (f) whether the timing of the proposal's authorization and implementation allows for cumulative impact assessment to be performed within a subsequent EIS required with or expected to accompany the proposal.

The CEQ definition of cumulative impact recognizes past, present, and reasonably foreseeable future actions. Past and present, or ongoing actions are identified and evaluated in Section III of this EIS (Description of the Affected Environment). However, some past and present actions may not have caused environmental impacts as of this date. Therefore, EIS authors have considered future impacts attributable to these past and present actions as part of their cumulative impact sections within their assessments. Frequently, the cumulative effects assessment cannot differentiate the incremental effect of each action (past, present, and future), due to uncertain conditions and methodological difficulties. In these circumstances, the EIS assumes that the aggregate impact across all types of actions constitutes the cumulative impact.

Future actions are assumed to be reasonably foreseeable for cumulative effects assessment in this EIS where there is a substantial commitment to execute the project, even though impacts can only be generically identified and project characteristics are merely presumed. Where subsequent and more discrete environmental assessment of such future actions is likely, then the cumulative effects assessment in this EIS can be considered an initial evaluation of the actions. However, where the commitment to execute the project or action is not assured, or if the project is sufficiently removed in time, e.g., 5 to 10 years, and where project definition and impact specification is presently conjectural, then the future action need not be considered for cumulative effects assessment in this EIS.

The phased or sequential consideration of environmental impacts on future actions is permitted under CEQ regulations implementing NEPA (40 CFR 1508.28). CEQ recognizes the "tiering" of environmental impact assessment when project development involves more than one stage over the life of the project, and where individual projects constitute implementation of a broader proposal, either in terms of program organization or region of consideration. The CEQ tiering procedure is applied in this EIS to yield phased documentation of cumulative effects assessment where either of the above criteria applies.

b. Review of Future Actions for Cumulative Effects Assessment: This section contains a brief description of major projects which may occur in the near future within or close to the proposed sale area. The projects listed in this section have been considered in the cumulative effects sections of this document (Sec. IV.). The listing is not comprehensive. Other projects that are not major or that may occur at some distance from the proposed sale area are not listed here, but are mentioned within the pertinent cumulative effects section(s).

Ongoing projects and the projected expansion of the domestic bottomfishing industry are not discussed in this section, nor are they analyzed within the cumulative effects sections of this DEIS. They are considered as part of the baseline environment. (The assumptions regarding the bottomfishing industry are described in detail in recently published (1981) reports by Alaska Consultants, Earl R. Combs, Inc., and the University of Alaska, Institute for Social and Economic Research.)

Proposed Small Boat Harbor St. Paul Island: The U.S. Army Corps of Engineers is currently studying the feasibility of constructing a small boat harbor on St. Paul Island. The Corps of Engineers recommended plan for the harbor would entail the dredging and enclosure of a 2.4 hectare (6 acre) entrance channel. Water depths for the basin would be 4.9 meters MLLW (16 ft); water depths in the entrance channel would reach 7 meters MLLW (23 ft). The project is being planned solely for the enhancement of the fishing industry. OCS support vessels draw between 6.1 to 7.6 meters (20-25 ft) and would, therefore, find moorage at the harbor difficult. If breakwater design testing and congressional appropriation procedures are both successfully concluded, work could begin on the project in 1987.

Proposed Samll Boat Harbor at Unalaska: A small boat harbor, located at the head of Dutch Harbor, is scheduled to be constructed by the city of Unalska before October of 1983. The boat harbor will be composed of three T-shaped docks. One of the docks will be a concrete structure capable of accommodating 12 vessels of the 90 foot class and 14 vessels of the 40 foot class. Water depths along the concrete pier should average about 6.1 meters (20 ft). The remaining T-docks will be floating structures and will provide 182.9 meters (600 ft) and 114.3 meters (375 ft), respectively, of berthing space. The former dock will be able to service vessels of 7.6 to 9.1 meter (25-30 ft) drafts while the latter will serve vessels with 6.1 meter (20 ft) drafts.

Proposed Airport Expansion at Unalaska: Currently, the State of Alaska is funding a design study on the viability of extending the runway at the Unalaska City Airport an additional 518 to 610 meters (1,700-2,000 ft). Supposing that the design and accompanying environmental studies are favorable and that legislative funding is available, construction on the new runway could begin by 1983. This extension would lengthen runway to 1,737 to 1,829 meters (5,700-6,000 ft) and enable it to handle most types of commercial jet aircraft.

Proposed Fishing Community at Cherinofski Point: The State of Alaska is funding a feasibility study for the establishment of a fishing community at Cherinofski Point. Should this study prove that such a project is economically feasible, this community may be constructed by 1984. Funding for this project would come from the State of Alaska.

Proposed Federal and State Oil and Gas Lease Sales: Impacts from the following proposed actions may interface in a cumulative manner with those from proposed lease sale 70:

Federal Proposals

- Sale No. 57, Norton Basin
Resource Estimates: 480 million barrels of oil, 2.01 trillion cubic feet of natural gas
Proposed Sale Date: May 1982
(See sale 57 DEIS (U.S. Department of the Interior, 1981) for further information.)

- Sale No. 75, North Aleutian Shelf
Resource Estimates: 370 million barrels of oil, 2.93 trillion cubic feet of natural gas
Proposed Sale Date: April 1983
(See BLM-OCS Technical Paper No. 1 (Tremont, 1981) for further information.)

- Sale No. 83, Navarin Basin
Basin-wide Resource Estimates: 2.47 billion barrels of oil, 8.95 trillion cubic feet of natural gas
Proposed Sale Data: December 1983

State Proposal

- Sale No. 41, Southwest Bristol Bay Uplands
Scheduled for the first quarter of 1984, this is an onshore oil and gas leas-

ing proposal on state lands surrounding Bristol Bay. Figure IV.A.7.-1 indicates the areal extent of the proposed sale. Actual state holdings in the area are currently very limited. Additional land may be transferred to the state, as a result of the Alaska Native Claims Settlement Act, by the proposed sale date. Resource estimates for this proposed sale area are not yet available from the state.

B. Alternative I - Proposal

The impact analyses contained in Sections IV.B.1. through IV.B.6 are based on a scenario which entails transportation of oil by pipeline to a landfall on the north side of the Alaska Peninsula, and then across the peninsula by pipeline to a terminal located at the edge of a bay on the southern side of the Alaska Peninsula. From there oil would be transported by tanker to an unspecified location in the contiguous U.S.

Refer to Section II of this EIS for a more detailed description of this scenario.

1. Impacts on Biological Resources:

a. Impacts on Fisheries: The proposed lease sale area encompasses an important fisheries area and is, at the minimum, seasonal habitat for many of the commercial species.

The eastern Bering Sea fisheries resources may be loosely classified into two major groups based on the usual position of the adults in the water column; benthic (demersal), and pelagic. The former dwell at or near the bottom of the ocean; the latter dwell closer to the surface. This impact analyses deals mainly with those species of commercial importance; the impacts on other finfish and shellfish can be assumed to be similar.

Impact of OCS Drilling Muds and Formation Water Discharges: This subsection identifies the acute and chronic effects of OCS drilling fluids and formation water discharges upon important fisheries and benthic communities. The chronic effects discussion encompasses marine biota generally. Refer to Section IV.H.1. for an evaluation of impacts of OCS discharges on water quality.

Important Alaska commercial species which have been subject to toxicity bioassays include coho, pink, and chum salmon (British Columbia Research, 1976) and pink, hump, and coonstripe shrimp.

Acute Effects of Drilling Muds: In spite of the variability among experimental techniques, the majority of data indicate that both whole muds and mud components, with the exception of bacteriocides, are relatively nontoxic. Abundant evidence indicates that lethal concentrations (greater than LD50) of the dissolved fraction of drilling fluid contaminants are only present within a few meters of the discharge pipe and that the apparent effects of drilling mud discharges are most limited (Ray, 1978; McAuliffe and Palmer, 1976). Available toxicity data indicate that adult cold water organisms are generally not more sensitive than temperate water organisms.

Preliminary conclusions of Rice (1980) concerning some drilling mud toxicity tests conducted with crustacean larvae (king, tanner, and dungeness crab and coonstripe, dock, and kelp shrimp) are:

(1) Crustacean larvae in our tests are more sensitive than reported LD50's for adult shrimp and fish.

(2) Suspended muds were about 5 to 10 times more toxic than water-soluble fractions (WSF) of mud.

(3) The length of time required for a toxic solution suspended mud or WSF to show adverse effects was noticeably longer than WSF's of oil.

(4) Mud WSF are more stable (persist longer) in seawater than petroleum hydrocarbon WSF's.

(5) Adverse effects to larvae appear to be caused primarily by physical aspects of the exposure rather than chemical toxicity.

(6) The toxicity of drilling muds tested appears to be correlated with lignosulfonate content. Bacteriocides within drilling fluids can be acutely toxic to tested biota. Specifically, halogenated phenols, quatenary amines, and diomine salts have LD50 values of less than 1.0 ppm. The aldehydes, for example formaldehyde, are generally less toxic with an LD50 between 50 and 400 ppm (Robichaux, 1975). The U.S. Geological Survey has issued a rule prohibiting use of halogenated phenols as a drilling fluid constituent (30 CFR 250.11, 250.43; 44 FR 39031). The acute effects of the sedimentary fraction of drilling muds and cuttings upon benthic communities is restricted to a smothering pheonomena where the rate of deposition exceeds approximately 5 centimeters on the sea floor (Dames and Moore, 1978).

Acute Effects of Petroleum Hydrocarbons: Acute toxicity tests have been performed on a variety of salmonoids, shrimp, crab, bottomfish, mollusks, and finfish (Trasky, 1978; Malins, 1977; Woofe, 1977; Katz, 1973; Mc Auliffe, 1966; Anderson et al., 1974). The tests have been performed on both warm and cold water environments with some tests having been performed on indigenous cold water species of Alaska. Standard 96-hour bioassay results on pink scallops were 0.8 ppm, on pink salmon fry 2.9 ppm, and on adult king crabs 4 ppm (Rice et al., 1976). The most sensitive bioassay results were reported on dungeness crab larvae at 0.04 ppm, with threshhold toxicity effects measured at 49 ppb (Caldwell, Calderone, and Mallon, 1977). The bioassays used water-soluable fractions or crude oil mechanical solutions as the test substance (Cook Inlet crude oil).

Comparison of the above toxic concentrations of the WSF of crude oil with known concentrations of dissolved petroleum hydrocarbons in produced water discharges is difficult. The difficulty turns on the definition of the WSF and the analytical testing procedure employed. The sum of the aromatic hydrocarbons tested in the Granite Point and Trading Bay production facilities constitutes most of the WSF set of toxic hydrocarbons identified by the National Marine Fisheries Service (NMFS) (Alaska Department of Environmental Conservation, 1978). The Marathon NPDEFS Permit Application for the Trading Bay facility tested for aromatic hydrocarbons according to the Alaska Department of Environmental Conservation and the NMFS analytical procedures which permit an estimation of total WSF and a comparison with toxicity study results. The total WSF concentrations from these facility discharges (2.6-6.7 ppm) are approximately 10^2 to 10^3 greater than the most sensitive toxicity test results (0.04 ppm for dungeness crab larvae).

With regards to formation waters, i.e., those encountered at drilling depths, it can be conservatively estimated that lethal effects of treated produced waters discharged from platforms on finfish and benthic species would not extend beyond 100 meters (330 ft) from the discharge source. This is based upon the dilution rates reported in the lower Cook Inlet rig monitoring studies.

Chronic Effects of Petroleum Hydrocarbons: At least three levels of effects upon marine biota can be postulated for suspected contaminants: (1) short-term lethal effects, (2) sublethal physiological effects, and (3) behaviorial effects (Percy and Mullin, 1975; Trasky, 1977). There is a substantial dispute among investigators as to whether wastewater discharges from OCS operations pose chronic adverse effects through the stages of sublethal, physiological, and behaviorial effects.

Representatives of the oil and gas industry argue that sufficient research has been done to demonstrate findings of no chronic adverse effects from drilling fluid discharges upon pelagic communities (Ray, 1978; American Petroleum Institute, 1979). Various scientists and resource agency officials disagree and argue that the available evidence is inadequate to demonstrate the finding of no chronic effects (Wennekens, 1975; Wright, 1975; NOAA, 1979; Richards, 1979; Reisch and Carr, 1978).

Table IV.B.1.a.-1 gives a summary of finfish and shellfish species, habitat, season of occurrence, and the potential interaction of oil with these items. For more detailed information regarding these interactions, refer to ADF&G (1978), Malins (1977), and USDI (1976).

Salmon, herring, and other pelagic finfish species and demersal finfish species, such as halibut and walleye pollock, occur at least seasonally throughout the St. George Basin. These finfish have been divided into groups for describing impacts.

Impact on Demersal Species: Flounders, cod, halibut, pollock, sablefish, and rockfish are all open ocean, bottom-dwelling fishes of the St. George Basin and surrounding area. These species have free-floating eggs and larvae. One to three months after fertilization, the eggs become buoyant and generally float at or near the surface until metamorphosis when they return to the bottom to feed and grow to maturity. Should a large hydrocarbon spill (10 Mbbls or more) occur in the Bering Sea at a time when these immature forms are at or near the surface, then the population of eggs/larvae would be reduced. Given the present knowledge as to the numbers and distribution of eastern Bering Sea egg/larvae concentrations, the extent of such an impact cannot be quantified except in general percentages; however, the vast numbers of these organisms, their wide distribution, and their seasonality make it very unlikely that even a large oil pollution event could reduce these numbers by as much as a small fraction of 1 percent.

Table IV.B.1.a.-1
Fish Species, Habitat Use, and Potential Oil Interactions

Species of Biota Group	Principal Habitat	Areas of Peak Occurrence	Season of Peak Occurrence	Area Use by Biotic Group	Potential Oil Biota Interaction
ADULTS					
Sockeye	Pelegic, Congregate in Estuaries	Nearshore; Anadromous Streams with Lakes; Lake systems of Bristol Bay	Late June to Mid-May	Spawning migration; rearing probable	Behavioral; Interference with open ocean migration patterns
Pink	Pelagic, Congregate in Estuaries	Nearshore; Anadromous Streams; Intertidal; Izembek Lagoon Bristol Bay; many Alaska Peninsula Streams, Aleutians	July to Mid-August even years	Spawning migration	Behavioral; Interference with migration toxic to spawn
Chum	Pelagic, Congregate in Estuaries	Nearshore; Anadromous Streams; Intertidal Izembek Lagoon, Herendeen Bay	July to September	Spawning migration	Behavioral; Interference with migration Toxic to spawn
Coho	Congregate in Estuaries	Nearshore; in most Alaska Peninsula streams in some numbers	August-October	Spawning migration	Behavioral; interference with open ocean migration
Chinook	Pelagic Congregate in Estuaries	Nearshore; Anadromous Streams; North Alaska Peninsula into Bristol Bay	May-July	Spawning migration	Behavioral; interference with migration routes
JUVENILES					
Sockeye	Enter Estuary after 1-3 years in fresh water lakes	Nearshore; Surface;	May to August	Smolting; Feeding	Toxicity; Reduced food supply; Behavioral; Ingestion
	Seaward Migration	Offshore, along Alaska Surface; Surface Peninsula	August to October	Outmigration; Feeding	Toxicity; Behavioral; Ingestion
Pink	Enter Estuary	Nearshore; Surface	Probable late fall	Smolting; Feeding	Toxicity; Reduced Food supply; Behavioral; ingestion

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Table IV.B.1.a.-1
Fish Species, Habitat Use, and Potential Oil Interactions--continued

Species of Biota Group	Principal Habitat	Areas of Peak Occurrence	Season of Peak Occurrence	Area Use by Biotic Group	Potential Oil Biota Interaction
	Seaward Migration	Undetermined	October to November	Outmigration; Feeding	Toxicity; Behavioral; Ingestion
Chum	Enter Estuary	Nearshore; Surface	March to June	Smolting; Feeding	Toxicity; Reduced food supply; Behavioral; Ingestion
	Seaward Migration	Undetermined	Mid-August to Late Fall	Outmigration; Feeding	Toxicity; Behavioral; Ingestion
Coho	Enter Estuary	Nearshore; Surface	March to July	Smolting; Feeding	Reduced food supply; Behavioral; Ingestion
	Seaward Migration	South and west along the Continental Shelf; Surface	Late Summer to Early Winter	Outmigration; Feeding	Behavioral; Ingestion
Chinook	Enter Estuary	Nearshore; Surface	June to Late August	Smolting; Feeding	Reduced food supply; Behavioral; Ingestion
	Seaward Migration	South and west along the Continental Shelf; Surface	Fall to Early Winter	Outmigration; Feeding	Behavioral; Ingestion
Dolly Varden	Congregate in Estuary	Nearshore; Surface	Early April to Late June; September to October	Smolting; Seeking overwintering streams; Feeding	Toxicity, Reduced food supply; Behavioral; Block access to overwintering streams; Ingestion
EGGS AND HATCHING					
Pink	Streams Intertidal	Aleutians; some north Alaska Peninsula streams	Late July to May	Incubation; Hatching; Emergence	Smothering; Toxicity

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Table IV.B.1.a.-1
Fish Species, Habitat Use, and Potential Oil Interactions--continued

Species of Biota Group	Principal Habitat	Areas of Peak Occurrence	Season of Peak Occurrence	Area Use by Biotic Group	Potential Oil Biota Interaction
Chum	Intertidal	Some north Alaska Peninsula Streams; Herendeen-Izembek	Late July to May	Incubation; Hatching; Emergence	Smothering; Toxicity
ADULTS					
Herring	Rocky Beach; kelps	Intertidal; Shallow Subtidal Same as Pink Salmon	Mid-May to Early-June	Spawning	Inhibit spawning; Toxic to spawn
	Benthic Overwintering	Near Bottom; northwest of the Pribilofs	Late Fall through Winter	Overwintering; No feeding	Behavioral
EGGS AND LARVAE					
Herring	Rocky Beach with kelps	Nursery Intertidal; Shallow Subtidal; Bay Areas	May to June	Incubation; Hatching	Toxicity; Smothering Reduced hatch
	Nearshore	Nursery Intertidal; Shallow Subtidal	May to Late Fall	Feeding	Reduced food supply; Toxicity; Ingestion
JUVENILES					
Herring	Nearshore	Surface; Bays and Inlets	Late Fall, Winter, Spring,	Feeding	Reduced food supply; Behavior; Toxicity; Ingestion
ADULTS					
Sablefish	Demersal	OCS deeper than 200 meters	Year-round	Feeding	Reduced food supply; Behavior; Toxicity; Ingestion
EGGS THROUGH LARVAE					
Sablefish	Pelagic	Undetermined	Early Spring to Late May	Incubation; Hatching; Feeding	Toxicity; Reduced food supply; Ingestion

Table IV.B.1.a.-1
Fish Species, Habitat Use, and Potential Oil Interactions--continued

Species of Biota Group	Principal Habitat	Areas of Peak Occurrence	Season of Peak Occurrence	Area Use by Biotic Group	Potential Oil Biota Interaction
EGGS					
Adult Walleye Pollock	Pelagic	OCS between 100 and 200 meters	Late Summer	Feeding	Ingestion
Eggs & Juvenile Walleye Pollock	Pelagic		March to June	Maturation	Toxicity, reduced food
ADULTS					
Pacific Cod	Demersal	Inshore embankments to; Intertidal	December to March	Spawning	Toxic to spawn; Inhibit spawning
LARVAE					
Pacific Cod	Demersal	Rocky; Shallow Subtidal; Intertidal	January to Late June	Feeding	Toxicity; Reduced food supply; Ingestion
Pacific Ocean Perch	Demersal	Shelf break and slope; 200-meter depths	Year-round	Spawning; Maturation; Feeding	Possible ingestion
Other rockfish	Demersal	Shelf break and slope;	Year-round	Spawning; Maturation;	Possible ingestion
ADULTS					
English Sole	Demersal	Nearshore	Winter, Summer	Spawning Feeding Feeding	Toxic to spawn; Behavioral

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Table IV.B.1.a.-1
Fish Species, Habitat Use, and Potential Oil Interactions--continued

Species of Biota Group	Principal Habitat	Areas of Peak Occurrence	Season of Peak Occurrence	Area Use by Biotic Group	Potential Oil Biota Interaction
EGGS AND LARVAE English Sole	Pelagic	Surface; Nearshore	Winter; Spring	Incubation; Feeding	Toxicity; Reduced food supply; Ingestion
ADULTS Petrale Sole	Demersal	Deep water areas		Feeding	Ingestion
ADULTS Dover Sole	Demersal	Deep water areas	Spring, Summer	Feeding	Ingestion
ADULTS Starry Flounder	Demersal	Nearshore	Winter; Summer	Spawning Feeding	Toxic to spawn; Behavioral, reduced food supply
EGGS AND LARVAE Starry Flounder	Pelagic	Near surface	Winter, Spring Summer	Incubation; Feeding	Toxicity; reduced food supply; Ingestion
ADULTS Pacific Halibut	Demersal	Near bottom; Near 200 m isobath	Winter	Spawning	Toxic to spawn; Behavioral
EGGS & LARVAE Pacific Halibut	Pelagic	Surface to 200-meters; inner Bristol Bay	Spring, Summer	Incubation; Feeding	Toxicity reduced

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Table IV.B.1.a.-1
Fish Species, Habitat Use, and Potential Oil Interactions--continued

Species of Biota Group	Principal Habitat	Areas of Peak Occurrence	Season of Peak Occurrence	Area Use by Biotic Group	Potential Oil Biota Interaction
ADULTS King Crab	Deep water; Come into shallow water to spawn	Well distributed throughout eastern Bering Sea	June to August	Feeding; Spawning depth	Low probability because of water
JUVENILES King Crab	Shallow water to 100 m	North Alaska Peninsula, Pribilofs near shore areas; not definitive	Year-round	Feeding; Rearing	Low potential for adverse effects
LARVAE King Crab	Semipelagic to benthic in shallow water	North Aalska Peninsula	Semipelagic March-July	Feeding; Rearing	Toxicity to larvae high
ADULTS Tanner Crab	Deep water to 50 m when spawning	Eastern Bering Sea	January-May in shallow water	Feeding; Spawning	Low probability because of water depth
LARVAE Tanner Crab	Semipelagic to benthic in shallow water		Semi-pelagic March	Feeding; Rearing	Toxicity to larvae high
ADULTS Dungeness Crab	To tide line; during spawning	South Alaska Peninsula Bays	Spawn October-December	Feeding; Spawning	Medium probability summer; Low in winter
LARVAE Dungeness Crab	Semipelagic to benthic in shallow water	Bays and Inlets; South Alaska Peninsula	Semi-pelagic June-December	Feeding; Rearing	Toxicity to larvae high

Table IV.B.1.a.-1
Fish Species, Habitat Use, and Potential Oil Interactions--continued

Species of Biota Group	Principal Habitat	Areas of Peak Occurrence	Season of Peak Occurrence	Area Use by Biotic Group	Potential Oil Biota Interaction
ADULTS					
Shrimp	Deep water (days) To surface (nights) Spawn in bays and around islands	Bays and Inlets north and south Alaska Peninsula	Year round spawn; Spawn August-September	Feeding; Spawning	Can affect eggs (carried on females) and food
LARVAE					
Shrimp	Semipelagic to benthic in shallow water	Bays and Inlets north and south Alaska Peninsula	February-July	Feeding; Rearing	Toxicity to larvae larvae high

Source: U.S. Dept. of Commerce, 1978; State of Alaska (ADF&G, 1978).

Species, such as walleye pollock, Pacific cod, black cod, Pacific ocean perch, and flatfish, are all demersal forms that live in deep water. The free-floating eggs and larval stages of these fish are vulnerable to oil contamination during relatively limited annual periods.

Information contained in the oilspill risk analysis (see Appendix E and Sec. IV.A.4.) does not show any significant impact where larval finfish forms are seasonally present. Near-surface water areas, a critical habitat for spawning and very early development of some demersal fishes, would not be impacted by an oilspill originating in the St. George Basin.

The eastern Bering Sea Pacific halibut population is dispersed throughout the area during the warmer-water summer months. It concentrates near the edge of the continental shelf along the 183-meter (600-ft) contour during the colder winter months. This species may now be recovering from overfishing and ancillary loss of juveniles killed by foreign fleets trawling for other species. It is unlikely that the species will ever attain population levels existent prior to the onset of the commercial fishery. Because adult halibut inhabit deeper waters, it is unlikely they would be affected by an oilspill. The larval or young forms of habitat at shallow depths could be affected by an oilspill; however, insufficient distribution data exists for determination of the probability of oilspill impact on the total larval population. A year class might be reduced, but over 20-year classes in the population (Best, 1969), a reduction in one would probably not be detectable by the commercial fishery or by surveys.

For most finfish populations, the adults would be less affected than larval and juvenile forms. Those fish species (groundfish, halibut, etc.) whose larval and juvenile life stages are in the upper portion of the water column and within 10 days of a possible spill point would be most vulnerable; weathering and biodegradation much reducing toxicity after this period. The oilspill risk analysis indicates, however, that demersal fish habitat would not be significantly impacted by an oilspill, including spawning/rearing areas; walleye pollock are the exception, but distribution is such that only a very minor part of the total population could be contacted by an oilspill.

Based on the oilspill risk analysis presented in Section IV.A.4 and Appendix E, the probability of an oilspill contacting egg/larval, halibut, yellowfin sole, Pacific cod, sablefish and immature rockfish is very unlikely. Walleye pollock eggs and larvae, however, would be very likely exposed to oil should a spill occur during the approximate 6-month period from spawning to onset of demersal existence, March through August annually. Additional studies are needed to precisely delineate the pollock spawning/rearing areas of the eastern Bering Sea relative to the proposed lease area and transportation routes. These studies should also determine densities for these immature forms; and periods of maximum densities.

Present limited data indicate that this proposed action would have a 93-percent probability of contacting pollock eggs at least once over a period of 3 to 30 days following a spill of 1,000 barrels of oil or greater. This is rated as a high risk but in essence, insignificant when total pollock egg/larvae area and numbers impacted (less than 100 km^2 are considered. Essentially less than 1 percent of the total egg/larvae mass could be contacted by a spill of this magnitude, an unlikely event when both seasonal occurrence of eggs/larvae are considered along with their wide distribution in the eastern Bering Sea. Drilling mud and formation water discharges are not considered to adversely impact the demersal finfishes of the area due to the components and the relatively small volume discharge to a vast area.

Conclusion: It is possible that some groundfish, halibut, and herring populations of the eastern Bering Sea could be reduced by an insignificant degree during the life of this proposal. Chronic, low-level oil pollution over a period of years could also slightly reduce finfish populations, mainly in shallow waters adjacent to the leases where some larval forms rear. Disturbance of the benthos by dredging for pipelines and other offshore construction could further impact these fisheries an unmeasureable amount. The probability of interaction is unlikely. If impact occurs the amount would be insignificant. The overall probability of occurrence is considered unlikely.

Effect of Additional Mitigating Measures: It has been suggested that all project personnel, including those far removed from the work area, be acquainted with the biological resources of the region. This orientation program would inform people as to how these fishery resources could be adversely affected by oil and gas development, and conversely how these affects could be averted. The orientation program would also inform people as to the operational methods employed by American and foreign fishing fleets and how conflicts may be avoided. Examples would be avoiding the discharge of materials injurious to some species and avoiding trawler operations by recognition of such vessels and their activities. This orientation program would be beneficial toward conservation of the fisheries resources of the eastern Bering Sea.

Cumulative Effects: Intensified commercial fishing effort by the developing Pribilof fisheries with concurrent onshore construction, i.e., small boat harbors, fish processing plants, and fishing industry suppliers, could contribute added degradation to fisheries habitat and water quality. This would cumulatively affect finfish resources. Other increased American and foreign fishing in the eastern Bering Sea could also result in cumulative effects, e.g., commercial fishing for capelin and/or commercial for classes in the Bering and Chukchi Seas could influence the impacts on fisheries identified by this proposal from tanker spills during transport within or near this lease area. Increased effort by the residents of the Pribilofs in their developing commercial fishery with related onshore construction; i.e., small boat harbors, processing plants and supply facilities, could add to the degradation of fisheries habitat and water quality. This would cumulatively affect finfish resources. A shift in effort to other species, e.g., shrimp, could further affect demersal fisheries. These cumulative effects are adjudged very localized and short-term.

Population increases in northwestern and arctic Alaska will lead to increased barge and ship traffic to supply these people, with concurrent probability for increased oilspills and impacts on fisheries.

While present in the bays and immediately offshore the south Alaska Peninsula, demersal finfisheries are relatively unexploited at this time and population data is not available for specific areas contemplated as possible parts for transshipment of oil from pipelines to tankers. Presumably impacts would be similar to those described for eastern Bering Sea species with the exception oilspills occurring in these more confined areas would more severely affect larval forms. Concurrent with this, however, would be increased shelter from adverse weather conditions as opposed to the north Alaska Peninsula.

Unavoidable Adverse Effects: No significant adverse effects on the demersal finfishes of the eastern Bering Sea are foreseen as a result of this proposal. Demersal finfish populations indigenous to the bay on the south Alaska Peninsula used as a pipeline terminus and tanker loading facility could be reduced if a transportation system for hydrocarbons was located there.

Impact on Salmon Species: It is unlikely that the five species of Pacific salmon that seasonally inhabit and/or transit the proposed lease sale area and the nearshore waters of Bristol Bay would be significantly adversely affected by an oil pollution event of any size, generated from oil and gas activities within the lease area. Adults and smolt would probably exhibit avoidance to both surface oil slicks and the water soluble fractions of petroleum from an open ocean spill.

In the event that oil from a blowout or pipeline rupture were to reach nearshore bays and lagoons at a time when salmon were present, these species could be affected, primarily through blocking migration of both adults and smolt. Generally, for salmon, this critical period extends from about mid-May through the end of September annually. Analysis of oilspill trajectories for spill points indicates that only during the fall, August to November, could oil reach the beaches of the north Alaska Peninsula within 10 days after it were spilled. The oilspill risk analysis (OSRA) indicates the probability of oil reaching the nearshore salmon migration areas within 10 days as less than 1 percent. This is assessed as an insignificant risk.

Oilspills in Unimak Pass area occurring during salmon migrations in June and late fall annually could delay salmon migrations. Of particular importance are the lagoons and bays of the north Alaska Peninsula and Aleutian Islands and the bays on the south Alaska Peninsula, the latter being possible locations for potential pipeline terminals and tanker loading ports. In these bays, adult salmon congregate prior to spawning, and some pink and chum salmon actually spawn in the intertidal areas. Migrant immature salmonids rear in the intertidal areas for a time in preparation to enter the ocean.

Juvenile and larval salmon appear to be the most sensitive to the toxic effects of oil (Rice, 1973). Should an oilspill contact inshore areas where immature salmon are present, some mortality could result. Additionally, these developing fish would be vulnerable to reduced growth and possibly even starvation if their phytoplankton and zooplankton food supply were killed by a very large oilspill (Hunter, 1972). Salmon fry migrations would be vulnerable to oilspills for upwards of several months after leaving their natal areas.

Pink salmon are the most vulnerable of salmon species to oilspills. They reside in intertidal areas on both sides of the Alaska Peninsula nearly year round, from egg stage to fingerling size. Oil reaching these shallow waters could more readily contact pink salmon eggs, kill the planktonic food supply for the larval pink salmon, and divert adults from natal spawning areas. In addition, pink salmon have alternate year-high spawning populations so that if a spill occurred and contacted them during that year, especially during periods of high concentrations of larvae or fry, mortality could result reducing local populations far into the future.

The sublethal effects from oil pollution, especially from the chronic low-level discharges of oil into the marine environment are potentially dangerous to fish. Feeding, reproduction, and social behavior in fish have been disrupted by soluble aromatic derivatives as low as 10 to 100 ppb (Todd et al., 1972; Sondheimer and Simeone, 1970). Interference with predator detection could also be disrupted (Nelson-Smith, 1973). This is of particular importance as regards to the sockeye run in Bristol Bay. Were a large oilspill to reach nearshore during the period from the end of May through early July, then the of these migration of these fish might, at the least, be delayed or possibly diverted from returning to Bristol Bay streams.

Conclusion: All north Alaska Peninsula salmon species (principally sockeye), adult and smolt, could be adversely affected to some unknown degree by this proposal, principally through interference during offshore migration. Impacts could also occur through reduction in food supply should oilspills reach estuaries. Pink and chum salmon would be the principal salmon species impacted by a tanker loading facility in any one of the bays on the south side of the Alaska Peninsula. Oilspills in these bays could block migration and/or reduce food for both adults and smolt.

Such adverse impacts are expected to be largely short-term and recovery thereafter would probably occur after no more than 5 years. The described impacts are not expected to have any significant long-term effect on the salmon resources of Bristol Bay or the south Alaska Peninsula. The probability of interaction is rated as unlikely. Impacts that occur would be considered insignificant to the population. The overall probability of impact is rated unlikely.

Effect of Additional Mitigating Measures: Because salmonids spend a portion of their life cycle inshore and in freshwater lakes and streams, site planning for onshore oil and gas facilities require avoidance of salmon streams and other spawning/rearing areas. State water quality standards for preservation of anadromous fish habitat are established and monitored; and while these measures are within purview of the state of Alaska, Federal agencies could coordinate closely insofar as transportation routes are concerned to alleviate potential for these adverse impacts. The sensitivity of these species to pollution could be stressed as a part of the suggested orientation program.

Cumulative Effects: Aside from this proposal, other lease sales in the Bering and Chukchi Seas could add to the impacts already discussed by additional oilspills from tankers transporting oil through the St. George Basin from those other areas. Potential oilspills from commercial and fishing vessels would also add to the total spillage. Increased population and decelopment in northwestern and arctic Alaska will increase vessel traffic as will American Bering Sea bottomfishing development. Probability of vessel collision and conflicts among industries using the same areas would increase.

A planned small boat harbor at St. Paul in the Pribilofs, expansion of the airport and fish processing facilities at Dutch Harbor, and conveyance of lands to Native entities will change socioeconomic patterns and the fisheries of the Bering Sea, creating added demands on these resources.

Unavoidable Adverse Effects: Localized salmon runs, indigenious to small areas where oil is transshipped could be adversely affected because of this proposal, mainly through oil spillage, which could alter salmon behavior, i.e., migration or affect their food supply.

Shellfish:

Crab Species: The three major species of crab (king, tanner, and Dungeness) have similar life histories in that the adults spend the winter months in deep (150-450 m [495-1,485 ft]) oceanic waters, and migrate to shallow (6-20 m [20-66 ft]) water in the spring or early summer. The eggs, which have been carried by the female for about a year from the previous year's spawning activities hatch and the young spend from 1 to 4 months (March-June) as free swimming planktonic larvae. After the larval stage, the juveniles assume the adult form, settle to the bottom, and spend from 1 to 5 years in shallow bays and estuarine areas before joining the adults on their migrations. The National Marine Fisheries Service has identified areas along the nort[illegible] Peninsula where king crab larval populations have been found (Fig. III.B. 1.b.-2). Blue king crab and the Korean horsehair crab spawn, rear, and live in the nearshore waters of the Pribilofs.

To a large extent, the crab resources of the eastern Bering Sea are distributed over a relatively wide area, and an oil pollution event would not contact any significant part of the total population. Some crab mortality could occur during offshore pipeline installation. Pipelines may also act as barriers to crab migrations, both physically and as a thermal block. This is very unlikely and engineering solutions are possible.

The larval forms are more susceptible to floating hydrocarbons; the juveniles are somewhat susceptible to hydrocarbons on and beneath the surface of the water. The adults would be affected by the oil that sinks to the bottom. All age groups would be affected by the reduction of food species. In the event of a large pollutant event or (over 10 Mbbls barrels) some of the young could be killed. During the life of this project, an estimated 1.5 oilspills of this size would occur. If these hydrocarbons settle to the bottom, the adults may also be killed, further reducing the population. Population reductions would affect the fishery. Crabs could be flavor tainted by contact with hydrocarbons and other pollutants, thus reducing their value. Based on the Oilspill Risk Analysis, these reductions would comprise an insignificant portion of the total shellfish population.

Exposure to chronic pollution associated with oil/gas development and production could affect the larval and juvenile life stages of crab and other shellfish species. King and dungeness crabs spend lengthy periods in shallow water; tanner crabs spend some time in shallow water. Effects of chronic exposure are as yet unknown, but could range from impairment of development of the animal to elimination of food species.

Studies by Rice and others (1976) tested Cook Inlet and other oils on a number of oceanic organisms, including larval tanner and Dungeness crab and juvenile king crab. They found that juvenile king crab quickly accumulated methylnapthalene and other aromatic compounds of oil in their body tissue and were able to quickly cleanse themselves after they were transferred from the contaminated water to clean water. They also found that at concentrations of oil equal to or just below the 96-hour TLm (medium tolerance limit) juvenile king crab respiration rates were depressed, indicating stress. Measurement of metabolism, however, does not appear to be a sensitive indicator of oil toxicity to crabs. In these studies, larval forms of tanner and Dungeness crab exhibited relatively high (10.8 and 7.1 ppm of oil, respectively) LGSO to Cook Inlet oil. The median effective concentration (ECm), or the amount of oil it takes to induce moribundity in larvae, however, was approximately 2 ppm for both species. Larvae can exist in the moribund stage several days before dying. Larvae do not recover from this stage. Of the life stages tested in this study, larvae appeared to be the most vulnerable to oil. From a quantitative standpoint, larvae were most sensitive to oil toxicity, especially during molting. Crustacean larvae may be particularly susceptible to oil toxicity compared with adults because they molt frequently.

Individual organisms subjected to sublethal exposures may undergo "ecological death" if they are incapable of adjusting to natural stresses in their environments because of this exposure. For example, during bioassay testing, postmolt tanner crab lost as many as seven legs, including both chelae, during short exposures to crude oil (Karinen and Rice, 1974). Even though the crabs lived through the exposure, they would not have survived in the natural environment.

Chronic exposure may adversely affect a portion of the population if the adults' ability to reproduce is seriously impaired. Physiological changes, such as reduced fecundity and delayed ovary development, or impaired behavioral mechanisms preventing location and identification of mate or timing of spawning, can impair reproduction. Thus, although chronic exposure might not directly kill the adult, it could adversely affect its ability to reproduce successfully so that, eventually, a portion of the population using the polluted habitat could be eliminated.

Some fractions of oil may sink to the bottom (Friede et al., 1972), where they would remain for some time and could taint shellfish. Instances have been cited where shellfish were tainted and their marketability was reduced by exposure to even slight amounts of oil (Blumer et al., 1970; Wilber, 1969).

Conclusion: No significant adverse effect on presently utilized shellfish populations would occur. The probability of interaction between shellfish and oil and gas development is unlikely. If an interaction should occur, the impacts would be insignificant. The overall probability of significant impact is considered unlikely.

If a major tanker spill reached larvae concentration areas within a short time after occurrences it could reduce crab populations including those on the south Alaska Peninsula. The probability of this is unlikely. If impacts occurred, the population loss would be significantly large. The overall probability of such impact is very low.

Effect of Additional Mitigating Measures: The orientation program would be most effective. Workers would be made aware of the impacts of oilspills and other discharges that could adversely impact shellfish resources.

Cumulative Effects: Aside from already assessed oilspill probabilities resulting from adoption of this proposal, additional Federal oil lease sales in Norton Sound, the North Aleutian Shelf, and Navarin Basin, as well as proposed State of Alaska oil lease sales in its tidelands and uplands, could affect the crab resources. Probability of oilspills from wells, pipelines, and tankers originating from these other areas could result in adverse, incremental impacts of the same types as described above.

Crab eggs and larvae would be most apt to be affected, although food sources for these crustacea could also be contaminated or reduced.

Aside from oilspills, increased utilization of bottomfish from the eastern Bering Sea, especially increased development of an American fishery for these species, would cumulatively effect fisheries resources. The commercial fishery for Korean horsehair crab off the Pribilofs is an example of an effort in this direction.

Unavoidable Adverse Effects: A very small unavoidable reduction in crab resources of the St. George Basin and the south Alaska Peninsula may be expected as a result of this proposed action. It is estimated that a small fraction of 1 percent of the total populations, both adults and larvae would be affected. These reductions would be relatively short-term and the potential for recovery to predevelopment population levels would be excellent.

Impacts on Other Shellfish: While three species of pandalid shrimp are found in the eastern Bering Sea, no commercial fishery exists in the proposed sale area at this time (personal communication, Paul Anderson, NMFS Kodiak).

Pavlof and Morzhovi Bays on the south Alaska Peninsula have been fished for shrimp; however at present, the stocks are severely depressed and a commercial closure is in effect.

Shrimp mate in the fall in coastal shallows with the eggs carried offshore by the females until they hatch the following spring (McLean et al., 1976). Young shrimp are found primarily in shallow water in bays and move into deeper water as they grow. In this shallow water these organisms would be most susceptible to oil pollution during adult molt periods in the spring (Rice et al., 1976). Adults undergo daily vertical migrations and are in the upper waters at night where they would be most vulnerable to contact with hydrocarbons.

Of the four species of shrimp considered in a past study (USDI, 1976), pink shrimp was the least resistant to water soluble fractions of crude oil. Shrimp larvae are apparently more sensitive to hydrocarbon toxicity at the time of molting, and later larval stages suffer a higher mortality rate than early larval stages. Larvae of spot shrimp appear to be much more sensitive to naphthalenes, an oil component, than previously demonstrated. Concentrations as low as 8 ppb cause narcosis (sleep or inactivity) followed by death in 1 or 2 days. In addition, shrimp larvae concentrate naphthalene and a naphthalene-protein complex 250 to 100 times the exposure levels, leading to the conclusion that ". . . aromatic hydrocarbons acquired in food may be metabolized quite differently from such compounds acquired from other routes . . ." (Sanborn and Malins, 1976).

Conclusion: Already severely depressed shrimp populations in Ikatan, Morzhovi, Pavlof, and Cold-Belkofski Bays on the south Alaska Peninsula could be further reduced by chronic or large oil pollution events resulting from developing these areas as a pipeline terminus and associated tanker loading port. The probability of this impact is rated as very low. If it were to occur, the impact would be locally severe. The overall probability of significant impact is very unlikely.

Effect of Additional Mitigating Measures: See previous section.

Cumulative Effects: See previous section.

Unavoidable Adverse Effects: See previous section.

Impacts on Commercial Fishing: Tanner crab appear to be the shellfish species most apt to be impacted by an oil pollution event originating in the eastern Bering Sea. Shrimp are the most vulnerable shellfish if a south Alaska Peninsula bay were utilized for transshipment of oil. The walleye pollock would be the finfish species most vulnerable to oil pollution in the Bering Sea, the pink salmon the most vulnerable for the south side bay. Reduction in fish populations could affect commercial fishermen in these areas.

During the exploration phase of this project, an estimated 12 support vessels would be based at Dutch Harbor, possibly an additional vessel at St. Paul in the Pribilofs. Based on past experience, exploratory activities are nonpolluting and little, if any, effect would be felt by commercial fishermen. While not foreclosed, the probability of additional seismic exploration is most unlikely and should this be necessary, some conflicts with the large numbers of fixed fishing gear in the area during limited fishing seasons could result. It should be possible, however, to schedule seismic exploration during closed fishing times. Careful boat traffic routing could reduce these potential conflicts. Overall, these impacts are assessed as minor, mitigatible, and of short-term.

If a producible discovery is made, there could be a number of adverse impacts attributable to the lease sale, affecting all fisheries and both foreign and domestic to some degree. These impacts would be: (1) loss of or damage to fishing gear, (2) loss of fishing area, (3) competition for labor and materials, (4) competition for moorage and onshore facilities, (5) loss of fishing time, and (6) inability to market catch because of flavor tainting by oil pollution.

Some benefits to the fishery will also accrue from oil and gas development in the eastern Bering Sea. These are: aid to distressed fishing vessels, maritime weather information collected by oil industry and transmitted to fishermen, and improved transportation.

Fishing gear loss in the eastern Bering Sea during the exploratory and production phases of oil and gas development, in the St. George Basin would be limited to crab pots; trawling gear is not likely to be lost or damaged; although accidental contact with pipelines could result in loss of trawl gear. For the south Alaska Peninsula, salmon gill nets, both drift and shoreline set nets, purse and beach seines could become contaminated by oil while some crab pots might be lost to tanker traffic.

Loss of crab pots could result by the cutting of buoy lines or entanglement and dragging the gear to deeper water where the buoy would be submerged and not recoverable. Compensation for such gear loss is provided by current legislation, including catch and potential catch lost; however, evidence is required and this is oftentimes difficult to obtain. See Alaska OCS Technical Paper No. 4 (Casey, 1981) for more information about the Fishermen's Contingency Fund.

Production areas including anchorage and avoidance areas around production platforms average about 800 hectares (2,000 acres). Eleven production rigs are assumed for the mean case of this proposal, removing about 8,800 hectares (22,000 acres) of potential fishing area from exploration. Trawl fishermen would probably be most affected by this loss of area, but in any case, the area lost is small as compared to total available fishing grounds. Site restrictions for very specific areas may be necessary as additional biological studies are performed.

Some competition for labor and materials could result in the area communities. Oil and related industries generally offer higher wages than fish processing plants and local government or private business. Should certain needed materials be in short supply, competition could conceivably deprive one industry while supplying the other; oil related ones possibly having financial ability to outbid others. Small businesses usually do not have this capability.

Crab and salmon would be the most susceptible to flavor tainting should a hydrocarbon spill occur during the fishing season for these species and cover an area where they are fished. Crab pots could be left on the ocean floor until the pollutants drifted away, and could then be pulled through clear water. Some additional expense for either cleaning old buoys and lines, or buying new ones, would be required and would be part of the impact.

To keep their catch alive, crab vessels pump and discharge water through the holding tanks. A fishing vessel might cross through an oil slick during night or other conditions of poor visibility and oil-contaminated water would be pumped to the catch, destroying it and/or its marketability although vessel pump intakes are some depth below the surface.

Salmon gear (gill nets) would probably need to be replaced should they become fouled by oil, and whatever salmon were in them would be lost to the market. The chance of impact is thought to be slight, but if it occurs, impact is probable. Damages due to oilspills are covered by the Offshore Oil Pollution Compensation Fund; however, considerable time is required to collect for damages See Alaska OCS Technical Paper No. 4 (Casey, 1981) for a discussion of this fund.

The loss of fishing time because of the proposal activities include, but are not limited to, time lost because of oil in the water over fishing grounds; gear replacement is slow, boats and gear must be cleaned, and help may not be available.

The labor requirements for the onshore construction projects related to this proposal are expected to have a minor effect on the fishing industry. The construction work force would likely consist of transient workers who would be housed at onsite construction camps. The projects would be sufficiently large to attract enough labor to an area so that the fishing industry employees that would be lost could be replaced.

The extent to which OCS uses of ocean space would increase fishing costs in a particular fishery would depend on the extent to which the fishing grounds would be used for OCS operations and on the nature of the fishing and OCS operations in areas of joint use. Gear type is a major determinant of potential conflicts. The crab fisheries use pot gear which is left unattended. The high concentration of the gear in some areas would result in a likely probability that gear losses could occur if other vessels enter the areas. OCS ocean space use would occur in the king and tanner crab grounds. Losses, therefore, would be expected to occur in these areas.

Bottomfish grounds are in the proposed area and the presence of structures and vessels related to oil development could restrict trawl operations to a minimum extent.

Gear loss is expected to be a major part of the increase in fishing costs in areas in which the two industries will compete for ocean space. Although the magnitude of the gear loss resulting from OCS operations cannot be determined, current gear loss in absolute terms or in terms of total fishing costs are of interest. CFEC data indicate that in the mid-1970's, the average gear loss of vessels participating in Alaska shellfish fisheries was approximately $8,400. This was about 13 percent of the total value of the gear used by these vessels, or about 17 percent of the fishing costs excluding labor costs. These gear loss estimates include the cost of gear itself and do not include the cost associated with lost fishing time. The gear losses due to OCS operations could exceed the current losses. Lost fishing time because of gear loss could cost far more than loss of crab gear.

Another aspect of the increased fishing cost is the cost associated with collisions between fishing vessels and OCS vessels or structures. Fishing vessel accident data indicate, for the United States as a whole, collisions account for approximately 18 percent of fishing boat accidents, and 45 percent of the collisions result from neglecting the boating rules. The implication is that additional vessel traffic would not substantially increase the cost of vessel accidents, particularly if more attention is paid to the boating rules.

Conclusion: Oilspills, reduced fishing area, vessel and gear conflicts, and competition for onshore facilities could all impact the commercial fishery in both the eastern Bering Sea and off the south Alaska Peninsula. Oilspills could adversely affect very localized populations of commercial species over short time periods. Area and material conflicts would be local, short-lived, and minor to the fishery as a whole. Probability of interaction is likely, the degree would be judged as insignificant. The overall probability of significant impact is unlikely.

Effect of Additional Mitigating Measures: The suggested orientation program would appraise the oil industry of the fishing activity and help to avoid conflicts without damage to these activities.

Cumulative Effects: Other proposed Federal oil lease sales in the Norton Basin, the North Aleutian Shelf, and the Navarin Basin would enlarge, and to some extent, accelerate the impacts on commercial fisheries discussed above.

Increased commercial fishing effort (i.e., fisheries for new species) could result in a greater number of gear and vessel conflicts between the oil industry and fishermen.

Seasonal marine transportation traffic is projected to increase as population increases in northwestern and arctic Alaska. This added traffic, also supply ing oil development, could cause conflicts with the fishing industry. These conflicts would not be significant.

Unavoidable Adverse Effects: The commercial fishing industry, domestic and foreign, would probably experience some adverse impacts from this proposal. There would be increased competition for ocean space, labor (short-term), and perhaps supplies (short-term). Small portions of the total fishing area could be lost for the life of the project. Some fishing gear, fishing time, and resultant catch could also be lost, despite compensation. Overall, impacts on the American commercial fishing industry would be insignificant.

b. Impacts on Marine & Coastal Birds:

Potential Types of Effects: Two types of factors may affect birds in the proposed sale area: environmental contaminants, chiefly oil pollution, and disturbance due to increased human activity. Although the current lack of long-term studies prohibits accurate prediction of chronic effects on avian species, available information can help to identify short-term effects associated with OCS activities.

Short-Term Oilspill Effects: Direct effects of released oil or petroleum products would vary depending on factors such as sex, age, reproductive status, metabolic requirements, and health of exposed individuals, as well as the pollutant, duration of exposure, and type of exposure (internal vs. external).

Most apparent in spill situations is the coating of animals with oil. This results in matting of the plumage as oil and water penetrates; flight is prevented by destruction of aerodynamic properties of feathers and the added weight of oil and water. Beyond preventing escape, destruction of the thermal barrier (air) by oiling allows heat loss as water contacts the skin, and the bird rapidly succumbs from hypothermia, shock, or drowning. Direct contact with oil usually is fatal.

Ingestion of oil, by swallowing oiled water, oil preened from the feathers, or contaminated food, causes a variety of internal disorders. Holmes (1981) discusses sub-lethal effects of oil ingestion, particularly on the endocrine glands and resultant effects on reproduction. These effects are evidenced by increased metabolism, respiratory rate, and water loss following reduction of insulation. Physical and physiological effects are reviewed by Holmes and Cronshaw (1977), Patten and Patten (1977), Connell and Millet (1980), and McEwan and Whitehead (1980). Also, oil transferred to eggs from the feathers or feet of adults has been found to markedly reduce hatchability, increase the incidence of deformities and retard growth rate of survivors (Grau et al., 1977; Ainley et al., 1978; Patten and Patten, 1979, Stickel and Dieter, 1979). Experiments have shown that the stress of oiling is additive to ordinary environmental stress, particularly during the breeding season.

Population and life history parameters important in assessing the effects of oilspills at the population level have been discussed by King and Sanger (1979) in calculating an Oil Vunerability Index for marine birds. Their calculations suggest that murres, auklets, and other alcids are highly vulnerable to oilspills since they spend much time foraging or resting on the water throughout the year, while waterfowl and shearwaters are somewhat less so. Hanson (1981) has utilized this index to compare regional vulnerabilities and Nero and Associates (1981) have examined seabird-oil interactions. Sensitivity of seabird populations to oilspills and projected recovery rates of impacted populations have been subjected to modeling analysis by Wiens et al. (1979).

The other major potential cause of adverse effects from OCS activities in birds is manmade disturbance, particularly noise and human presence. One of the interrelated, potentially serious disturbance problems specifically identifiable with OCS activities is increased air and boat traffic near important nesting areas. The effects of aircraft, especially helicopter noise and presence over nesting colonial birds and waterfowl, have been documented. Low flying aircraft passing near bird colonies frighten a large proportion of adult birds from their nests, leaving eggs and young not displaced from nesting ledges to rocks below by the mass exodus, vulnerable to exposure and predation (Jones and Petersen, 1979; Hunt, 1976). Preliminary evidence has indicated that repeated disturbance could significantly reduce hatching success, fledging success, and perhaps, cause adult abandonment of eggs and young (Gollup et al., 1978). Other potential disturbance problems associated with OCS development include possible displacement of birds from important feeding and staging areas due to increased air and boat traffic, and disturbance due to locating onshore facilities near coastal nesting areas.

Because of the non-uniform distribution of food resources, nesting habitat, and suitable staging areas adjacent to the St. George Basin proposed sale area, avian populations are concentrated where the resources are abundant. As a result of this distribution many species are subject to greater impacts from oilspills and disturbance than if distribution were uniform. At no time is the St. George Basin area devoid of large numbers of birds, but clearly the greatest numbers are at risk during the breeding season, May to October, when vast numbers of seabirds are foraging near the nesting colonies in the Pribilof Islands, eastern Aleutian Islands, south Alaska Peninsula, and Unimak Pass. Waterfowl populations are most vulnerable during spring and fall migration and the post-breeding molt period, when large numbers gather in the lagoons along the north side of the Alaska Peninsula. Substantial numbers also overwinter along the peninsula and in the Aleutian Islands.

Over 6 million colonial marine birds nest in areas adjacent to the proposed sale. In addition, over 1 million waterfowl and shorebirds utilize adjacent coastal habitats during spring, fall, and winter, and an estimated 8 to 10 million southern hemishphere shearwaters spend the summer foraging in the Bering Sea.

Analysis: Conditional probabilities of oilspill contact (Tables 20-35 and N17-N24, Appendix E) with Impacts Zones (Fig. E-3) or Boundary Segments (Fig. IV.A.4.c.-1) referred to in this analysis were taken or calculated from Samuels et al. (1981) and assume development as given in Section II.A. Probabilities of oilspill contact from hypothetical spill points (shown on Fig. IV.A.4.b.-1) within the proposed sale area with impact zones are given in Table 7. For comparison of alternatives and transportation scenarios, values for spills greater than 1,000 barrels, and trajectory periods of up to 10 days are used.

Site-Specific Impacts: Areas of major importance to marine and coastal birds that could be affected by transport of oil through False Pass or across the Alaska Peninsula via pipeline, and tanker from a south side bay, include Izembek and Nelson Lagoons (spring and fall waterfowl and shorebird staging), embayments along the south side of the peninsula (overwintering waterfowl), and islands adjoining the south peninsula shore (seabird breeding colonies, overwintering waterfowl and seabirds). Potential for major impact to large shearwater flocks in summer also exists offshore of the south peninsula and Unimak Island. Lagoons along the north shore of the Alaska Peninsula are especially important as staging areas for 75 to 100 percent of three waterfowl species' North American populations.

Probability of oil movement from the proposed sale area into the area offshore of Izembek Lagoon (Impact Zone 11) is 41 percent, indicating potentially high risk of contact for the large flocks of shearwaters that forage throughout this area in summer, as well as other seabirds from colonies on nearby Amak Island. Immense shearwater flocks of up to 1 million individuals have been sighted in this area, and flocks of 100,000 are not uncommon. Overall bird density ranges from 100 to 1,000 birds per square kilometer, comparable to summer densities recorded in the vicinity of the Pribilof Islands.

Reflecting the prevailing WSW winds, hypothetical summer and fall oilspills originating in the proposed sale area (Liu and Leendertse, 1981) consistently move towards the peninsula. However, longshore currents trending northeastward would tend to deflect spills parallel to the peninsula, probably preventing most from reaching shore or entering lagoons, as suggested by contact probability of 0 percent in the immediate vicinity of Izembek Lagoon (Boundary Segment 7). However, this probability may underestimate the risk to the lagoons since contact probabilities do not incorporate spills from ships or pipelines, the most probable sources of oil pollution in this area. Also, occurrence of a spill in the vicinity of a lagoon entrance coincident with strong onshore winds and/or flood-tide (generally much stronger than longshore current) could make oil entry into the lagoons a likely event. Oil entering lagoons during spring or fall intensive-use periods could have catastrophic effects on populations of several waterfowl species. During these periods 400,000 to over 500,000 waterfowl utilize the Izembek refuge lagoon system alone. In addition, long-term effects could occur through slow release of sediment-entrained oil, or indirectly on food resources, either causing reduction or facilitating ingestion by birds (e.g., brant-eelgrass). Use of transportation routes further up the peninsula similarly would affect Nelson Lagoon and Port Moller.

Disturbance of large flocks of waterfowl utilizing the peninsula lagoons in spring and fall may result from increased air traffic and human presence during periods of construction.

During the breeding season tanker traffic serving terminals located in Alaska Peninsula south shore bays could threaten the 1.0 million seabirds which nest on adjoining islands. Since a high proportion of this number are highly oil-sensitive species (petrels, alcids), oilspill contact could result in 25 to 50 percent mortality in a large segment of the breeding population. Low reproductive rate and slow maturation of most seabirds would require many years to recover from such a loss. Such effects are likely to be localized unless occurrences at several major colonies seriously deplete breeding stocks, or chronic pollution results in long-term regional effects. The westward-flowing Alaska Stream would tend to sweep oilspills away from major colonies in this area and towards Unimak Pass, possibly threatening the large numbers of foraging seabirds that utilize the pass and adjacent islands. Waterfowl overwintering in Cold Bay and other bays on the south shore of the Alaska Peninsula could be impacted by oilspills resulting from tanker operations.

As a result of pipeline transport of oil across the Alaska Peninsula and tankering from a south Alaska Peninsula bay, industry activities could impact bird populations utilizing three areas: 1) shallow offshore and nearshore shelf areas adjacent to the north peninsula shore and Unimak Islands from May to September, 2) lagoons of the north peninsula shore in spring (March, April, and May) and fall (September, October, and November), and 3) areas adjacent to the penisula's south side in both winter (December-March) and summer (June-September).

Conclusion: Interaction between oilspills and highly mobile shearwater flocks frequenting waters north of the peninsula is considered unlikely. If interaction occurred, a significant effect is likely. The overall probability of a significant impact occurring in this area is considered unlikely.

Migratory waterfowl staging in north side lagoons are very unlikely to encounter oilspills originating in the proposed sale area, except possibly under certain wind and tidal circumstances; however, if oil were to enter the lagoons, a significant reduction of several species would occur. Overall probability of significant impacts occurring as a result of events external to the lagoons is considered unlikely.

To the south of the peninsula, major oil-seabird interaction is unlikely; however, if oilspills occurred in nearshore areas, interaction with overwintering waterfowl is considered likely. In either case contact may result in a significant impact but overall, few species populations are likely to experience a significant interaction. Probability of oilspills originating on the south side of the peninsula reaching Unimak Pass is unknown, but consideration of currents and distances involved suggests that significant interaction would be unlikely.

Effect of Additional Mitigating Measures: Information to Lessees (Bird and Mammal Protection, Sec. II.B.1.c.) is the most effective protective measure available to this agency (DOI) by which seabird colonies and other bird concentrations could be protected from behavioral disturbance by support and supply activities. It is assumed that voluntary compliance with this Information to Lessees would be sufficient to minimize most sale-related disturbance from aircraft or vessels in the vicinity of the proposed sale. Existing migratory bird treaties with various nations, as well as local hunting regulations, could further mitigate behavioral disturbance of avian populations. Current oilspill containment and cleanup techniques appear insufficient to cope with substantial releases of oil in the Bering Sea environment. Whether prevention of oil from entering lagoons is feasible has not been demonstrated; however, locations of oil containment and cleanup equipment near critical lagoon entrances, with local transport and deployment services available during spring and fall migration periods, may provide the means to lessen projected impacts on waterfowl populations.

Cumulative Effects: Activities which may produce cumulative effects on birds include projects listed in Section IV.A.7., other Federal proposed or future OCS lease sales, State of Alaska proposed or future lease sales, international fishing vessel operation, and subsistence or other harvests. In addition to any other impacts, seabird colonies (Tolstoi Cliffs, Village Cliffs) flanking the site of a proposed small boat harbor (Village Cove) on St. Paul Island (Sec. IV.A.7.) may be affected by disturbance during construction, and habitat degradation during and after the project is completed. Also, construction activities associated with the runway extension at Dutch Harbor may result in habitat degradation which would affect marine bird populations in the immediate vicinity. It is unknown how extensive cumulative direct effects of oilspills resulting from oil and gas production or transportation would be in terms of ultimate population response of marine and coastal birds, or how individual actions might contribute proportionally to overall cumulative impacts. While many seabirds do not undertake extensive migration, some do migrate through or overwinter in or near other proposed sale areas, and thereby are subject to increased oilspill risk. Most waterfowl and shorebirds are highly migratory and thus likely to migrate through, or overwinter or breed near other state or Federal proposed lease sale areas. Spills and/or disturbance which seriously impact breeding stocks of certain seabird species at more than one major colony could effect a significant reduction of the regional populations. Other factors which may make a substantial but at present unknown contribution to cumulative impacts include mortality resulting from birds accidently gill-netted (estimated to number up to 300,000 annually as a result of the Japanese North Pacific/Bering Sea salmon fishery), and long-term effects of habitat degradation, disturbance and possible alteration or reduction of food resources.

Unavoidable Adverse Effects: The extent of unavoidable adverse effects associated with this proposal is unknown, but may be limited primarily to localized, short-term impacts due to oilspills or localized but presently unidentified effects of disturbance. Although long-term effects of exposure to oil or disturbance currently are unknown, they may be considered unavoidable.

c. Impacts on Marine Mammals: (Northern fur seal, Steller sea lion, Pacific harbor seal, spotted seal, ribbon seal, and sea otter.)

Potential Types of Effects: Two types of factors may affect marine mammals in the proposed sale 70 area: environmental contaminants, chiefly oil pollution, and disturbance due to increased human activity. Although the current lack of long-term studies prohibits accurate prediction of chronic effects on mammalian species, available information can help to identify short-term effects associated with OCS activities.

Short-Term Direct Oilspill Effects: Effects of oil on marine mammals reported in the literature are reviewed by Geraci and St. Aubin (1980). Most apparent in spill situations is the coating of animals with oil; however, unequivocal evidence for mortality of marine mammals caused by oiling in the wild has not been obtained. In laboratory studies Kooyman et al. (1976, 1977) reported increased thermal conductance of oiled northern fur seal and sea otter pelts, indicating loss of the thermal barrier.

Hair seals and sea lions, whose insulation is provided by a thick layer of blubber, apparently suffer no serious thermal effects (hypothermia) from pelage oiling (Kooyman et al., 1976, 1977; Geraci and Smith, 1977). However, pelage degradation and subsequent wetting has been shown to have serious thermal consequences for sea otters and northern fur seals. Oiling of two sea otters by Kooyman and Costa (1978) resulted in a 1.4X increase in metabolic rate in response to the increased thermal conductance. In addition, both animals contracted pneumonia and one died having been unsuccessful at grooming its fur to original condition. Kooyman et al. (1976) reported significant metabolic rate increases in oiled northern fur seals. The increased maintenance costs following contact with oil, when added to other stresses such as pregnancy, lactation, fasting, molting, food shortages or severe weather, are likely to have a profound effect upon the health of these fur-insulated species. Hair seal pups which have long juvenile pelage and lack a thick subcutaneous fat layer are similarly at risk when contacted by oil. These studies suggest that even light oiling may have marked detrimental effects on the thermoregulatory abilities of sea otters, fur seals, and hair seal pups, while effects on other adult pinnipeds would be slight.

A variety of apparently non-lethal effects of oil-marine mammal contact have been demonstrated or could be expected to occur on the basis of petroleum characteristics. For example, oil irritates sensitive tissues, particularly the eyes. Geraci and Smith (1976a) found that ringed seals began lacrimating, blinking, and squinting soon after immersion in oiled seawater. After 24 hours all seals displayed severe conjunctivitis, swollen nictitating membranes, and corneal lesions. Presumably, occurrence of this effect in the wild would interfere with the foraging ability as well as most other activities. These investigators also found transient kidney and possible liver lesions (but no detectable lung pathology), thought to be associated with inhalation of volatile hydrocarbons. Marine mammals also may ingest potentially toxic oil when exposed to a spill. Intake may be incidental to surface activities, a result of grooming, by eating contaminated food (probably negligible in the short-term), or from coated mothers by nursing pups. Results of experiments suggest that short-term toxicity of ingested oil is negligible. Harp seals fed up to 75 milliliters of crude oil showed no evidence of tissue damage (Geraci and Smith, 1976a). Apparently this species, and presumably other pinnipeds, is capable of excreting and/or detoxifying hydrocarbons absorbed during short-term exposure, but the effect of sustained and/or chronic exposure remains unknown.

Nor are behavioral responses of marine mammals to oil well known, including the basic question of whether they can detect or will avoid oil spills. In laboratory tests, northern fur seals avoided immersion in water after oiling, indicating their awareness of the situation (Kooyman et al., 1976). In the field, 400 hair seals were observed to refuse re-entry into water contaminated with oil (Anonymous, 1971). Dependence of pinnipeds on a substrate during mating, pupping, nursing and for hauling out may force them into repeated exposure to shoreline or ice-edge accumulations of oil (Davis and Anderson, 1976; Burns and Frost, 1979). Since field observations of sea lions suggest that scent is important in recognition of pups by females (Schneider, ADF&G, personal communication), it is possible that contact with oil could inhibit such recognition in these and other pinnipeds and lead to abandonment and starvation of young. This could have an especially serious effect in the fur seal and sea lion with nursing periods of 3 to 4 and 8 to 11 months, respectively.

Because of their restricted breeding range, oil-sensitive fur insulation and concentration of foraging and migration activity within or adjacent to the proposed sale area, the nothern fur seal is considered the pelagic species at greatest risk, being both sensitive (easily impacted physiologically by oil contact) and vulnerable (large proportion of population breeding in the vicinity of the proposed sale area). Sea otters are accorded a similar status in shallow coastal waters due to their intolerance of oiling.

Long-Term Oilspill Effects: Since stressors of various types affect natural populations throughout the annual cycle and over longer intervals, it is likely that the additional stress of sustained or chronic exposure of marine mammals to spilled oil would result in greater physiological and behavioral effects than discussed above. However, the extent to which chronic oil contact would contribute to or alter susceptibility to existing physiological and/or behavioral stresses associated with increased density, increased metabolic demands, habitat degradation, or reduced food availability is not readily predictable, and probably can be assessed only by monitoring efforts under field conditions. At present, several pinnipeds of the Bering Sea are at or near maximum levels of population and show somewhat more pathological conditions than counterparts in the Gulf of Alaska (Fay et al., 1979). In view of this situation, it seems reasonable to consider these populations, which currently appear to be under stress, at greater risk if they were to come under the influence of chronic oil pollution than populations not so stressed.

Indirect Oilspill Effects: Indirect effects of oil pollution on marine mammals principally would be those associated with changes in the availability and suitability of food resources. Five of the six species considered (sea lion, fur seal, harbor seal, spotted seal, ribbon seal) which primarily rely on fish and/or pelagic invertebrates may be affected locally in proportion to localized impacts on prey species. Lowry et al. (1978, 1979) reviewed mechanisms by which prey species such as herring, capelin, cod, shrimps, and amphipods may be affected by oil toxicity. They concluded that pollutant levels high enough to cause large scale die-off of prey probably would be very localized and expressed more concern with long-term sublethal effects on prey populations. Sea otters, which feed on relatively sedentary benthic invertebrates, may be the most likely to exhibit local trophic-related oilspill effects.

It is likely that habitat degradation resulting from frequent contamination would lead to temporary avoidance and possible long-term abandonment by marine mammals. Abandonment of traditional breeding and hauling grounds, foraging areas, and migration routes in favor of less suitable areas could have a severe impact on these populations.

Effects of Noise and Disturbance: It is well known that high intensity shock waves associated with explosives can be injurious to marine organisms. Low frequency sound, such as may result from drilling, platform operation, and ship operation, are not likely to be physically destructive. Shock waves associated with seismic air guns would not immediately be harmful to marine mammals (Geraci and St. Aubin, 1980), although the noise may affect behavior.

The potential for impact of noise on marine mammals depends on two major factors: (1) characteristics and transmission of the noise, and (2) behavioral and physiological sensitivity of affected species.

Airborne Noise: Air traffic support of oil and gas activities could have adverse effects on marine mammals which consistently occupy breeding and hauling areas near the proposed sale area. Pitcher and Calkins (1977, 1979) state that harbor seals are noted for mass exodus from hauling areas when disturbed by low flying aircraft. Burns and Harbo (1977) reported that spotted seals reacted "strongly" to aircraft noise, even at considerable distance, by erratically racing across ice floes and diving off. One of the more serious results of such stampedes in harbor seals, the separation of mother-pup pairs, was studied by Johnson (1977). He found that if separation occurred before mother-pup recognition was firmly established, generally within 3 weeks of birth, chance of pup survival was greatly reduced, to zero in the case of separation during the first week. Stampedes into the water also can result in injury to the young. Repeated disturbance may lead to abandonment of traditional breeding or hauling areas in favor of less suitable sites (Geraci and St. Aubin, 1980).

Underwater Noise: The extent to which pinnipeds use underwater acoustics is not well known, but it would be unusual if it were not used for intraspecific communication and predator avoidance, and possibly food location, spatial orientation, etc. Noise characteristics and transmission range, auditory capabilities of various species and responses to noise are reviewed by Geraci and St. Aubin (1980), Turl (1980), and in the Draft EIS for proposed sale 57 (USDI, 1981). Most animals show evidence of habituation to low-level background noise, but this has not been well documented in marine mammals. Speculation exists concerning the potential contribution of chronic industrial noise to physiological stress of marine mammals, and possible interaction with existing stresses on individuals or populations.

Analysis: Conditional probabilities of oilspill contact (Tables 20-35 and N17-N24, Appendix E) with Impact Zones (Fig. E-3) or Boundary Segments (Fig. IV.A.4.c.-1) referred to in this analysis were taken or calculated from Samuels et al. (1981) and assume development as given in Section II.A. Probabilities of oilspill contact from hypothetical spill points (shown on Fig. IV.A.4.b.-1) within the proposed sale area are given in Table 7. For comparisons of alternatives and transportation scenarios, values for spills greater than 1,000 barrels and trajectory periods of up to 10 days are used.

Site-Specific Impacts: Areas of major importance to marine mammals that could be affected by transport of oil through False Pass or across the Alaska Peninsula via pipeline, and tanker from a south side bay, include lagoons and nearshore areas of the peninsula's north side (sea otter, sea lion, harbor seal, year round) and south side nearshore areas, reefs, islands (sea otters, sea lion, harbor seal) and offshore areas (fur seal, April-June and October-December).

Possibility for impact on marine mammal populations also exists near the Pribilof Islands with this transportation scenario, but, based on contact probabilities generally below 15 percent (Impact Zones 21-28), is considered potentially less significant than in areas near the transportation route.

Probability of oil movement from the proposed sale area into the area offshore of Izembek Lagoon (Impact Zones 8, 11) is 41 percent, suggesting potentially high risks of contact for major sea otter and harbor seal concentrations as well as the sea lion rookeries on Amak Island (Graphic 3). Sea otters are particularly at risk but harbor seal and sea lion hauling areas also could be fouled, with serious consequences during the breeding period (May-August).

Model-generated summer and fall oilspills originating in the proposed sale area (Liu and Leendertse, 1981) consistently move towards the Alaska Peninsula as a result of prevailing WSW winds. But longshore currents moving northeastward tend to deflect spills parallel to the peninsula, probably preventing most from reaching shore or entering lagoons, as suggested by the 0 percent probability of contact in the immediate vicinity of Izembek Lagoon (Boundary Segment 7). However, this probability may underestimate the risk to shoreline and lagoons since contact probabilities don't incorporate spills from ships or pipelines, the most probable source of oil pollution in this area. Occurrence of a spill coincident with strong onshore winds and/or flood tide (generally much stronger than longshore currents) could make oil landfall or entry into lagoons a likely event, severely impacting the sea otter, sea lion, and harbor seal populations.

Effects of exposure to chronic pollution and disturbance from vessels servicing onshore facilities is unknown, but may be reflected in long-term population changes. Pipeline routes further north along the peninsula would result in similar effects in Nelson Lagoon and Port Moller.

Oilspills and disturbance from tankers servicing a south side terminal likewise could impact high density sea otter populations and large sea lion rookeries in the Sandman Reefs and Sanak Islands areas. Equally important, tanker traffic during spring and fall would transect the principal fur seal migration route with potential for serious short-term impacts from oilspills, as well as long-term effects on population movements. The westward flowing Alaska Stream would tend to sweep oilspills occurring in this area towards the fur seal migration corridor, including Unimak Pass through which most seals travel to the breeding grounds. Nevertheless, of the transportation scenarios discussed in this EIS, the cross-peninsula route probably would generate the least impact on northern fur seals over much of their migration corridor.

As a result of pipeline transport of oil across the Alaska Peninsula and tankering from a south side bay, industry activities could impact marine mammal populations utilizing three areas near the Alaska Peninsula: 1) lagoons and nearshore areas adjacent to the north peninsula shore and Unimak

Island, year round; 2) reefs, islands, and nearshore areas adjacent to south peninsula shore, year round; and 3) a broad offshore corridor south of the peninsula to the eastern Aleutian passes in spring and fall.

Conclusion: On the north side of the peninsula, interaction of marine mammals with oilspills originating in the proposed sale area is unlikely. However, because of their extreme sensitivity to oil, relatively sedentary population, and concentration in this area, sea otters are very likely to experience a significant impact if contacted by oil. Thus, probability of a locally significant sea otter-oilspill interaction is considered likely. Sea lions and harbor seals are considered unlikely to experience significant impacts. Overall, significant interactions with these two species are considered unlikely, although contact in areas of high density and breeding activity such as Amak Island (sea lion) and Izembek Lagoon (harbor seal) is likely to have a significant local impact.

On the south side of the peninsula these species are considered to be at similar risk. Fur seals migrating offshore probably are unlikely to encounter oilspills. Interaction which does occur is likely to be physiologically significant but involves such a relatively small proportion of the population that overall probability of significant interaction is considered unlikely. Near the Pribilof Islands, probability of significant impact on marine mammal populations is considered unlikely. Likelihood of long-term impacts from chronic exposure of marine mammals to oil pollution or disturbance is unknown at the present time.

Effect of Additional Mitigating Measures: Information to Lessees (Bird and Mammal Protection, Sec. II.B.l.c.) is the most effective protective measure available to this agency (DOI) by which concentrations of sensitive marine mammals at coastal breeding and hauling areas, as well as where migration routes are constricted (e.g., Unimak Pass) can be protected from disturbance due to aircraft or vessels. It is assumed that voluntary compliance with this Information to Lessees would be sufficient to minimize most sale related disturbances associated with support and supply activities.

Appropriate authorities may issue specific regulations under existing legislation (e.g., Marine Mammal Protection Act of 1972) which could further minimize disturbance of wildlife. Information to Lessees (Bird and Mammal Protection) does not mitigate impacts that may be associated with geophysical exploration, in particular underwater vibrations which may occur on lease tracts but which may affect adjacent areas during breeding periods. Appropriate authorities designated by the Marine Mammal Protection Act would address such impacts on a case-by-case basis, and is presently done during permit review procedures.

Current oilspill containment and cleanup techniques appear insufficient to cope with substantial releases of oil in the Bering Sea environment. Whether prevention of oil from entering lagoons and other embayments is feasible has not been demonstrated; however, location of oil containment and cleanup equipment at strategic points adjacent to the proposed sale area, with local transport and deployment services available during breeding, molting, and migration periods, may provide the means to lessen projected impacts on marine mammals.

Cumulative Effects: Factors which may produce cumulative effects on marine mammals include other Federal OCS proposed or future lease sales, international fishing vessel activity, and subsistence or other harvests. In addition to any other impacts, fur seal rookeries (Tolstoi, Corbatch) near the site of a proposed small boat harbor (Village Cove) on St. Paul Island (Sec. IV.A.7.) may be affected by disturbance during construction, and habitat degradation during and after the project is completed. Also, construction activities associated with extension of the existing airstrip at Dutch Harbor may result in habitat degradation affecting marine mammal populations in the immediate vicinity. It is unknown how extensive cumulative direct effects of oilspills associated with the various proposed state and Federal lease sales due to oil and gas production or transportation would be in terms of ultimate population response of marine mammals. In the course of their migrations, northern fur seal, spotted seal, and ribbon seal populations may travel through or near several proposed oil and gas lease sales, and thus, risks of oilspill impacts may be increased.

Oil tankers associated with several sales would increase oilspill risks in areas of more intense traffic, such as Unimak Pass or south of the Alaska Peninsula. Cumulative disturbance due to tanker traffic, seismic exploration, pipeline construction, support and supply aircraft, fishing vessels, and other nonpetroleum industry disturbance sources also may affect behavior of such populations. Cumulative indirect effects may be associated with ingestion of contaminated prey for specialized feeders such as sea otters. The eastern Aleutian Steller sea lion population recently has declined significantly (Braham et al., 1980). The reason(s) are unknown, but this trend probably would be accelerated by any substantial additional impacts resulting from oil and gas activities. Other factors such as future offshore fisheries harvests (e.g., via reduction or change in marine mammal food sources) may have as much or more effect on marine mammals than the proposed sale. At present, it is impossible to quantify the cumulative impacts, but it is assumed they would be generally greater than those resulting from the proposed sale alone.

Unavoidable Adverse Effects: The extent of unavoidable adverse effects associated with this proposal is unknown, but may be limited primarily to localized, short-term, impacts due to oilspills or localized but presently unidentified effects of disturbance. However, since long-term effects of exposure to oil or disturbance currently are unknown, they may be considered unavoidable.

d. Impacts on Endangered Species and Non-Endangered Cetaceans: Major impact-producing agents affecting endangered cetaceans and birds could be oil and gas pollution, noise or other disturbance, and habitat losses.

Endangered Species Consultation: Pursuant to requirements under the Endangered Species Act of 1973, as amended, formal Section 7 endangered species consultation of the Bureau of Land Management with National Marine Fisheries Service and the U.S. Fish and Wildlife Service was conducted on June 25, 1980, regarding exploratory phases of the proposed oil and gas lease sales in the Bering Sea. Informal consultation with appropriate officials was also conducted prior to and subsequent to the latter meetings. Consultation will continue as necessary. On August 22, 1980, a biological opinion (Appendix D) was received from the U.S. Fish and Wildlife Service regarding potential effects of exploration activities on endangered birds in which it was concluded:

> "Since nesting and migration areas are relatively distant from the project area and the potential for an oilspill resulting from exploration activities is small, it is my biological opinion that the proposed oil and gas leasing and exploration activities associated with proposed OCS Sales 57, 70, 75, and 83 are not likely to jeopardize the continued existence of the listed species considered herein, and because there is no designated Critical Habitat within or near the project area, Critical Habitat will not be affected."

Formal consultation with NMFS on endangered whales began June 25, 1980. As per agreement between NMFS and BLM, an extended response period was necessary in preparing the biological opinion on the effects of exploration activities on endangered whales. The biological opinion has not been received, but it is expected prior to publication of the FEIS.

The following material describes potential types of effects on endangered cetaceans, endangered birds, and non-endangered cetaceans.

Cetaceans--Direct and Indirect Effects of Oil and Gas Pollution: There is no evidence that endangered cetaceans are able to detect hydrocarbon pollution. Accounts from past oilspills show that marine mammals such as seals and sea lions may not avoid oil; however, there has yet to be found a confirmed case of a whale, dolphin, or porpoise coated or fouled with oil (Geraci and St. Aubin, 1979) as a result of contact made while alive. Toothed whales may be more likely to detect oil due to certain sensory capabilities (Geraci and St. Aubin, 1980). In general, little if anything is known about the ability of many cetaceans to avoid spilled oil. Although oiled cetaceans have not been observed, the nature of their skin suggests that they may be vulnerable to effects of surface contact with hydrocarbons (Geraci and St. Aubin, 1979). The epidermis is not keratinized, but composed of live cells (Geraci and St. Aubin, 1979). Geraci and St. Aubin (1979) reported that cetacean epidermis is virtually unshielded from the environment, and may react to substances such as crude oil or gas condensates in a manner similar to sensitive mucous membranes.

Field observation of at least one instance of possible contact of gray whales with spilled oil did not show evidence of extreme effects. In 1969, the entire northward migration of gray whales passed through or near the area contaminated by the Santa Barbara Channel spill, yet the number of gray whale strandings was not significantly different from previous years (Brownell, 1971). Gas chromatograph analysis of tissues of a gray whale stranded in the vicinity of the spill did not indicate the presence of crude oil.

In addition to potential cutaneous contact with oil (or gas), inhalation of toxic substance or plugging of blowholes by oil have been cited as possible threats to cetaceans. Certainly the former is a possibility to the extent that whales may be in the vicinity of a spill prior to the evaporation of toxic compounds. The latter event would be very unlikely to occur. The typical breathing cycle of cetaceans involves an "explosive" exhalation followed by an immediate inspiration and an abrupt closure of the blowhole (Geraci and St. Aubin, 1979). This mechanism prevents inhalation of water and should be discriminatory of gas condensates and oil; however, toxic hydrocarbon gas could be inhaled. The effects of gas condensate or gas vapor inhalation on cetaceans are unknown.

Cetacean vulnerability to hydrocarbon ingestion would vary with species, type of hydrocarbon, and nature of the spill. Tomilin (1955) reported that cetaceans, especially benthic feeders, have a poorly developed sense of taste, and the presence of foreign bodies in cetacean stomachs attests to this. Thus, whales may not be able to differentiate between hydrocarbon contaminated and uncontaminated food. Another potential direct effect of spilled oil on certain whales is that of fouling of baleen, with a subsequent decrease in feeding efficiency. The probability of such fouling and effects on feeding efficiency is directly linked to probabilities of spills and whale contact with such spills. Preliminary results of ongoing experimental research suggests that oil, under controlled conditions, may cause a reduction in filtering efficiency of bowhead baleen (Braithwaite, 1981). However, it is not possible to predict eventual population response on endangered whales as a result of baleen fouling at this time. Effects of bioaccumulation of toxic substances in cetaceans are not well understood.

Of possible indirect impacts from oil and gas activities, effects on food sources from acute or chronic hydrocarbon pollution is of concern. Most of the baleen whales of the north Pacific are seasonal feeders, relying almost entirely on the abundant food sources of the Gulf of Alaska, Bering Sea, and Arctic Ocean for nourishment, as well as living off stored blubber reserves while migrating and in their winter range. The destruction of benthic amphipods or altered productivity of benthic communities may adversely affect gray whales. Evidence exists (e.g., Percy, 1976; Bellan-Santini, 1980) showing that certain amphipods and their community structure or function may be affected by pollution. For at least a few gray whales, indirect effects through food resources can be considered a possibility, and their probability directly related to probability and future extent of pollution events (see Site-Specific Impacts). Such effects could possibly occur in areas utilized by gray whales near the Pribilofs or along the northern shores of the Alaska Peninsula where limited feeding may occur during migration. Since they are less restricted in feeding habits or not numerous in the proposed sale area, it is unlikely that other populations such as bowhead, humpback, fin, sperm, blue, or sei whales would be adversely affected through impacts on food resources, although individual whales may experience indirect effects on a localized or temporary basis.

Local or temporary contamination or chronic pollution resulting in reduced productivity of plankton or other important food items may be an additional stress to endangered whale populations. The extent to which physiological stress resulting indirectly from oil pollution may affect endangered whales or interact with other stressors is highly debatable, and any prediction of stress-related impacts of oil pollution on endangered whales would be premature.

Cetaceans--Noise and Disturbance: The reader is directed to USDI (1981: Sec. IV.B.2.d.) for general information on underwater noise sources and characteristics. The response of animals to acoustic stimuli have generally shown variance in behavioral and physiological effects, dependent on species s tudied, characteristics of the stimuli (e.g., amplitude, frequency, pulsed or non-pulsed), season, ambient noise, previous exposure of the animal, physiological or reproductive state of the animal, and other factors.

Research on effects on noise, particularly that associated with oil operations on endangered cetaceans has been limited. Field observations of responses of cetaceans to disturbance, which presently exist, provide some index of sensitivity of whales to noise and disturbance. For example, with respect to the gray whale in southern California, Dohl et al. (1978) concluded that "The reasons for this apparent increase in utilization of offshore waters are unknown, but might be the result of increased human activity in the Bight, increased gray whale numbers, or some combination of both factors." There are no confirmed reports or documented evidence of the latter species actively and consistently avoiding exploratory or production platforms, helicopters, seismic operations, or other OCS activity; in fact, numbers of gray whales nearshore along the California coast have remained relatively stable in spite of human activities, including oil exploration (personal communication, T.P. Dohl, University of California at Santa Cruz, 1980). Reeves (1977) identified potential conflicts of disturbance sources and breeding gray whales in Baja, California. Subsequently, Swartz and Jones (1978) reported that although boat traffic in the Laguna San Ignatio (a gray whale breeding habitat) increased 30 percent over the previous season, boat activity did not affect large scale movements or distribution of gray whales. Although localized avoidance behaviors were observed, gray whales became accustomed to boat traffic as the period of exposure to such disturbance increased (Swartz and Jones, 1978). Geraci and Smith (1979) concluded that species such as the gray whale seem to coexist well with human activities, and most animals become accustomed to low level background noise such as that associated with most ship traffic and petroleum activities. Shipping records show that more than 28,000 vessel arrivals occur in coastal waters of northern and central California each year in the southern portion of the gray whale range. (This figure does not include arrivals at the major port of Los Angeles.) At least 7263 marine fishing vessels were registered in California in 1976-1977 (Oliphant, 1979), and probably more than 24,000 marine fishing vessels operate throughout its range in Alaska, Washington, Oregon, and California (U.S. Department of Commerce, 1973:270). Additionally, large numbers of recreation boats and other sources of underwater noise also subject this species to noise effects. In spite of the large amount of acoustic energy introduced throughout their range, gray whale population recovery has been dramatic. In short, evidence to date suggests that the gray whale population has not responded adversely to existing sources of disturbance and, therefore, may not be particularly sensitive to many types of noise associated with offshore petroleum industry operations. However, little definitive data exists to verify that migratory or feeding behavior of gray whales would be unaffected by disturbance in areas previously devoid of factors such as drilling, seismic exploration, or helicopter traffic.

Other endangered whales may be more sensitive to noise and other disturbing factors. Leitzell (1979) concluded that "Uncontrolled increase of vessel traffic, particularly of erratically travelling charter-use/pleasure craft, probably has altered the behavior of humpback whales in Glacier Bay, and thus may be implicated in their departure from the bay the past two years." However, other factors may also have affected humpback utilization of the latter area. Evidence of humpback sensitivity to disturbance has been reported in its wintering grounds (Norris and Reeves, 1978). However, Payne (1978) listed numerous instances of apparent insensitivity of humpback whales to noise. Preliminary field experiments on bowhead whales showed statistically significant differences in behavioral parameters as a result of nearby boat activity, including decreased time spent at surface, decreased number of blows per surfacing, increased spreading out of grouped animals, and significant changes in directional orientation (Fraker, et al., 1981). However, flight responses seemed to be of brief duration.

Loud noise is not unusual in the marine environment; in fact some species of baleen whales may vocalize at source levels exceeding that of natural ice-related noise. A single observation by Fraker et al. (1981) of bowheads in the vicinity of active seismic operations (source levels ranging from 220-270 db) did not indicate unusual behaviors; however, this observation does not constitute sufficient data upon which to draw a conclusion regarding the significance of disturbance due to geophysical (seismic) exploration. Therefore, until further information is obtained, the latter source of disturbance could be considered as a factor which may possibly affect endangered whales adversely. This source of disturbance may be of particular concern due to a zone of influence of noise above ambient levels potentially of radius in the hundreds of miles.

Probably of major significance to endangered cetaceans which may occur in or near the proposed sale area is interaction of noise with other visible phenomena, or previous experience in terms of ultimate behavioral and physiological responses. Prediction of behavioral or physiological responses of large cetaceans to disturbance and noise will remain difficult, even for those types of disturbance which are consistently associated with oil and gas development. As for other impact-producing agents, some speculation exists as to the possible induction or contribution to physiological stress on cetaceans which may result from sustained noise or disturbance. Such an impact could affect reproductive rates, resistance to disease, or endocrine balances of individuals. The extent to which disturbance due to oil and gas exploration and development in the proposed sale area would act as a stressor is uncertain, and any prediction of the extent of stress-related impacts of noise would be premature.

Other potential influences on cetaceans include marine disposal of drilling muds, formation waters, and cooling waters; shoreline alterations; facility siting; dredging and filling; and secondary development. The extent of these activities during exploration should not be a major influence on endangered or other cetaceans. Decreased whale productivity could be sustained as a result of loss of habitat, or habitat deterioration occurring during development. These effects would be localized, although incremental losses could be significant to the extent that the overall summation of regional effects would deteriorate available or important habitat (see the following discussion on cumulative effects).

Endangered Birds: A factor possibly affecting peregrine falcons would be effects associated with uncontrolled airborne noise and disturbance, especially that associated with supply aircraft serving offshore facilities and potentially passing close to nesting sites. Disturbance from such sources could reduce the survival of nestlings. Construction of onshore facilities near peregrine nesting sites could also be a potential source of disturbance. Although very unlikely, oilspills may also impact peregrines or migrating Aleutian Canada geese either through direct contact or indirectly through disruption and loss of prey organisms. However, since endangered peregrines are not known to occur near the proposed sale area (see Sec. III.B.4.) and since Aleutian Canada geese may occur south of the proposed sale only on a transient basis, such effects are unlikely to occur. Since the Aleutian Canada goose nesting area on Buldir Island is at least 700 miles to the west, it is under virtually no risk due to the proposed sale.

Site-Specific Impacts: Endangered whales most likely to occur in or near the proposed sale area include gray, fin, and humpback whales. Most gray whales are found primarily in Unimak Pass, along the north side of Unimak Island and along the Alaska Peninsula during spring and in the northeastern lease area in fall. Humpback whales could occur anywhere in the lease area but sightings tend to concentrate in the Unimak Pass area and offshore in the vicinity of Unalaska and Akutan Islands. Thus, spill occurrence in coastal areas from Unalaska west to Unimak Pass could potentially interact with humpback whales or their habitat. Fin whales (as well as sperm whales) are likely to be found along or near the shelf break and the central lease areas (see Sec. III.C.4.). If development occurred to the extent estimated for the proposal (Sec. II.A.), and if oil were transported by pipeline to a loading point on the south side of the Alaska Peninsula/Unimak Island region (Transportation Scenario A), there would be a 7 to 41 percent chance (Appendix E, Table 20, hypothetical targets 5-8) that oil spills would intersect the outer Unimak Pass region and as much as a 16 percent chance the spill would penetrate to the inner pass region and northern shoreline of Unimak Island (Appendix E, Table 20, hypothetical targets 9-10). (Note: unless otherwise specified, spill probabilities referred to in this section are those of a 10-day duration, 1000 barrel spill simulation.) Since the probability figures referenced above are derived from year-long exposure simulations, it follows that the spring/summer risk levels (when whales are most abundant) would be somewhat lower. Spills moving through the areas represented by above-defined targets could interact with endangered whales frequenting Unimak Pass at some unknown probability less than the referenced figure (since they are absent part of the year) or with their habitat at least to an extent as likely as that figure. Areas offshore and centrally located in relation to the proposed sale represented by targets 14-17, Appendix E, Table 20, may be at as much as 29 to 60 percent chance of spill occurrence. These areas are representative of regions inhabited by endangered whale species known to migrate and feed along the continental shelf such as fin, sperm, or humpback whales. Offshore areas perimetering St. George Island (Appendix E, Table 20 hypothetical targets 22-24) and St. Paul Island (Appendix E, Table 20 hypothetical targets 26-27) would be at 6 to 29 percent chance of spill movements into those areas. These results show that although shorelines of the Pribilofs show relatively low risk (Appendix E, Table 28), as a result of the proposed development, offshore areas which may be occupied by cetaceans such as sperm whales or fin whales are at a higher risk. It should be noted that certain unconditional oilspill risk levels reviewed above are lower than what would be incurred for other transportation modes (see Sec.IV.B.7.).

Reference to Appendix E, Table 7 shows "conditional" probability of spills hitting certain hypothetical targets. That is, probability of spills hitting certain areas if they originated at certain points. Under the proposal, tracts near or at spill point no. 20 would be leased. Spills originating at that point would have a 10 to 56 percent chance of hitting hypothetical targets 5-8, representing the outer Unimak Pass region. There would be a 0 to 17 percent conditional chance that spills would penetrate to hypothetical targets 9-10, representing the inner pass region (Appendix E, Table 7).

Similarly, under the proposal, tracts at or near spill points P_3, P_4, and P_5 would be leased which pose a conditional probability of 5 to 15 percent chance of moving towards St. Paul Island and through hypothetical targets 26-27 and as high as a 47 percent chance of moving towards St. George Island (Appendix E, Table 7, Spill Point P_3, hypothetical target 23). Given the above probabilities of spill intersection with certain areas, as well as spill frequency statistics shown in Appendix E, Table 1, it can be concluded that it is very likely that oilspills will interact with endangered or non-endangered cetaceans or their habitat as a result of the proposed sale.

In general, oilspills can be considered unlikely to have significant indirect food-chain related effects on endangered whales since direct effects on pelagic zooplankton may be transitory. Since for certain endangered species (such as sei, fin, humpback, blue, and sperm whales) only portions of the population are suspected of entering the Bering Sea, significant population-wide direct effects are unlikely even if spills do occur. The gray whale population has shown at least one instance of relative tolerance to direct oilspill effects, and thus, it seems possible that the latter population would not be adversely affected in the event of spills. Although right whales historically frequented the proposed sale area, they are now so rare as to make the probability of any interaction extremely low. Therefore, if spills occur, the probability that a significant interaction between spills and endangered whales would occur is unlikely. (A significant effect in this range would imply a short- or long-term change in distribution or behavior leading to altered productivity rates, mortaility rates, or population status of the subject population.)

Due to their transient nature through the proposed sale area, it is unlikely that endangered Aleutian Canada geese will interact with oilspills associated with the proposed sale. Since their nesting habitat is at least 700 miles west of the proposed sale area, it is very unlikely that spills would contact that important habitat. Endangered peregrine falcons are generally absent. Therefore it is very unlikely that the proposed sale will have significant effects on endangered birds.

It is not possible to quantify with precision the ultimate effects of noise and disturbance which may be associated with the proposed sale or as to how such disturbance would modify cetacean behavior or physiology. Whether various types of disturbance would affect whales would ultimately depend on factors such as characteristics of disturbance sources and species-specific sensitivities; the latter attributes are poorly understood, the extent of the former very uncertain. Also, in order to predict the relative significance of petroleum industry noise and disturbance effects on endangered cetaceans, it would be essential to be able to understand and differentiate similar effects as may be associated with past and future fishing vessel activity. At present, it is difficult, if not impossible to do so. In general, overall noise and activity associated with exploration phases are expected to be of a relatively insignificant contribution, particularly as compared to ambient levels (e.g., fishing vessel activity). Therefore, it is unlikely that disturbance associated with exploration phases would significantly affect what are probably relatively dispersed endangered whale populations characteristic of the lease area proper. It is possible that noise associated with platforms or vessels during the development and production phases could have long term localized effects on cetacean behavior, perhaps on the behavior of humpback whales which may be a more sensitive species. Geophysical exploration activities associated with the proposed sale may be a source of disturbance with the greatest zone of influence, but its effects on whales are generally unknown. Since most activities would be relatively far from the migratory corridor of gray whales, it is unlikely that a significant number of gray whales would interact with noise sources situated within the lease area proper. However, noise associated with offshore loading or tanker traffic due to the proposed sale may have at least localized effects on cetacean behavior. Increased tanker traffic through Unimak Pass or to various potential ports could create localized increases in noise levels. Therefore, it can be concluded it is possible that noise and disturbance associated with the development and production phases of the proposed sale could lead to localized change in cetacean distribution and/or habitat abandonment; however, it is impossible to say at this time whether such effects would significantly alter the population status of any particular species.

Conclusion: Based on oilspill risk analyses, it can be concluded that it is very likely that oilspills would interact with endangered cetaceans or their habitat. It is unlikely that such interaction, if it occurred, would significantly affect endangered whale populations frequenting the area. Therefore, it is unlikely that significant interactions would occur. It is unlikely that oilspills will significantly interact with or affect endangered avian species. The unlikely event of a large spill intersecting the gray whale migration is probably the only potential oilspill event that could possibly have a significant impact on an whale population. It is not possible to quantify with precision ultimate effects on endangered or non-endangered cetaceans of noise and disturbance which may be associated with the proposed sale. It is possible that noise and disturbance associated with the proposed sale may have localized effects on cetacean behavior or distribution, especially in the vicinity of construction sites, platforms, or transportation terminus points during development and production phases. It is not known whether significant population-wide effects of noise and other disturbance on endangered whales could occur as a result of the proposed sale.

Effect of Additional Mitigating Measures: Information to Lessees on Bird and Mammal Protection may reduce risks to endangered and non-endangered cetaceans or endangered birds below those discussed above. This Information to Lessees may eliminate certain localized impacts on individual cetacean or small population segments, but in general, such reduction of risk probably would contribute only a minor overall benefit to local cetacean populations. This conclusion is derived because the factors most likely to have signficant long-term effects, if any, such as geophysical exploration, construction, or overall increment in vessel-introduced noise and activity would not necessarily be modified by the proposed Notice to Lessees on Bird and Mammal Protection.

Cumulative Effects: For the purpose of this discussion, cumulative effects refers to the sum of direct and indirect oilspill effects, disturbance effects, potential reduction of habitat quantity or quality, or other factors such as subsistence harvest. Industrial effects are assumed to be similar qualitatively to those discussed previously. Factors which may produce overall cumulative effects on endangered species, especially whales, include those projects listed in Section IV.A.7., other proposed or future Federal offshore oil and gas lease sales, subsistence harvest, and other non-petroleum industry sources of oilspills or disturbance. Certainly of concern is cumulative impact of oilspills or other pollution associated with the above listed projects. It is unknown how extensive direct effects associated with proposed Federal, state, or private lease sales on endangered whales or birds may be. Probability of such effects may increase if all the potential developments take place, especially for species such as gray whales for which entire populations are known to migrate through several proposed sale areas. Cumulative indirect effects on gray whales may occur if future development takes place in important feeding areas immediately to the west of the proposed sale 57 area (Norton Sound). Also, gray whales travel near or through Federal lease sales such as sale 53 (central and northern California coast), sale 55 (eastern Gulf of Alaska), and proposed sale 75 (North Aleutian Shelf). However, due to the extreme uncertainty regarding the extent of development in these areas and regarding the probability of effects on endangered species, it is impossible to predict the type or magnitude of future cumulative pollution-related effects on endangered species. Cumulative spill effects may be greatest at locations where tanker traffic (due to several sales) may be focused, e.g., the Bering Strait or Unimak Pass.

Cumulative acoustical disturbances associated with proposed state and Federal lease sales may affect endangered cetaceans. The relative significance of disturbance due to proposed Federal sales, as it compares to state leasing or non-petroleum industry sources are unknown. Although not feasible to perform at this time with any accuracy, the prediction of long term and population-wide behavioral responses of cetaceans from cumulative noise would have to take into account all noise sources throughout a species range. To be included would be all marine vessel traffic, all recreational vessel traffic, all sale and non-sale-specific geophysical exploration activity, all aircraft, all pumping stations, all natural sources, etc. For some species such as the gray whale, OCS development may constitute only a minor portion of total acoustical stimuli. For humpback whales which may be more sensitive, cumulative OCS development may be of more significance. If several proposed sales were to yield large discoveries of oil and gas, intensive production activities and resultant increases in human activity, increased localized or shipping corridor disturbance, increased pollution, etc., cumulative oilspills or disturbance could be significant for potentially sensitive or severely depleted coastal species such as the humpback whales. Cumulative industrial disturbance, especially during migratory seasons, may be greatest at locations where tanker traffic due to several sales may be focused, e.g., Unimak Pass. As suggested previously, long-term, ecosystem-wide cumulative effects of chronic pollution may be of concern since change in total ecosystem productivity is at least a remote possibility. However, it is unknown how such an impact may ultimately affect endangered whales.

The proposed sale is not expected to contribute signficantly to cumulative factors which may affect endangered birds.

Unavoidable Adverse Effects: The magnitude of unavoidable impacts on endangered whales is unknown. In the event of development, high probability of spill occurrence in certain areas indicates that interaction between whales or their habitat and oilspills is likely. Noise and other forms of disturbance associated with the proposed sale (e.g., disturbance due to tanker traffic or sale-related geophysical activities) may cause temporary behavioral responses or long term change in species distribution and productivity. However, present knowledge of petroleum-related activity and its relationship to cetaceans is insufficient to predict the magnitude of many unavoidable adverse impacts on endangered whales that may be associated with the proposed sale. Unavoidable adverse impacts on endangered birds as a result of this proposed sale are likely to be minimal, if existent at all.

2. Impacts on Social Systems:

a. Impacts on Population: The following discussion is based on the Technical Paper No. 1 (Tremont, 1981); Alaska Consultants Technical Report 59, 1981; and the rationale contained in Section IV.B.4. for allocating the number and population effects of OCS employment among communities for the development scenarios. Population growth resulting from the rapid development of the bottomfishing industry in the region, assumed part of the base case, is discussed in Section III.C.1.c. and summarized on Table III.C.1.-3. The communities most likely to be affected by OCS development include St. Paul, Unalaska, and Cold Bay. The relationship between OCS-induced population and the anticipated future growth without the proposal in these communities is shown on Table IV.B.2.a.-1 by 5-year intervals.

Offshore exploration of the proposed lease sale area may expected to be staged from a marine support base in Unalaska and an air support operation in Cold Bay. The component of the population working offshore is anticipated to transit predominately through Cold Bay enroute to destinations outside the region and state. Should exploration produce the discovery of commercial quantities of oil and gas, development of the offshore field could take place by means of several alternate scenarios. This discussion is based on the south side of the Alaska Peninsula terminal scenario. The population effects from other scenarios are discussed in Section IV.B.7.

As shown on Table IV.B.2.a.-1, a south peninsula terminal site could produce the largest population effects in Cold Bay. This is the primary staging area for offshore air support during all phases over the life of the project, a function consistent with the existing and foreseeable future role of the community in the region. The OCS role is modified in the south peninsula terminal scenario, with the community serving as the base for overseeing the construction of the facility in the short-run and absorbing a portion of production and managerial personnel families during the operation of the project. OCS-related population would comprise about half the future population of Cold Bay in the event of a south peninsula terminal, contributing 39 percent (211 persons) of the total population of 543 by 1985 and 56 percent (538 persons) of the total population of 960 persons in 1990. The population induced by OCS activities should compliment and diversify the community of Cold Bay in the long-term life of the field when considered in the context of the existing and foreseeable characteristics of the population and the functional role played by the community in the region.

The population effects in St. Paul and Unalaska from the south peninsula terminal scenario would be considerably less than in Cold Bay. In St. Paul, OCS-induced population would constitute 1 percent or less (less than 10 persons) of total population over the life of the field. Population effects in Unalaska would be most apparent during the initial development phase, when Unalaska serves as a staging area for offshore marine support operations. In 1985, OCS-induced population constitutes 15 percent (528 persons) of the total

Table IV.B.2.a.-1
OCS-Related Population as a Percentage of Total Projected Population
Primary South Peninsula Scenario and Other Scenarios

Community:		1985				1990				1995[1/]				2000[2/]			
		Non OCS	OCS	Total	OCS as % of Total	Non OCS	OCS	Total	OCS as % of Total	Non OCS	OCS	Total	OCS as % of Total	Non OCS	OCS	Total	OCS as % of Total
St. Paul																	
	1	525	8	533	1	1,423	6	1,429	*	1,423	6	1,429	*	1,423	5	1,428	*
	2	525	197	722	27	1,423	827	2,250	37	1,423	386	1,809	21	1,423	521	1,944	27
	3	525	4	529	1	1,423	0	1,423	*	1,423	2	1,425	*	1,423	2	1,425	*
	4	525	13	538	2	1,423	23	1,446	2	1,423	21	1,444	1	1,423	24	1,447	2
Unalaska																	
	1	2,945	528	3,473	15	6,280	255	6,535	4	10,586	296	10,882	3	13,221	380	13,601	3
	2	2,945	368	3,313	11	6,280	38	6,318	1	10,586	40	10,626	*	13,221	56	13,277	*
	3	2,945	623	3,568	17	6,280	771	7,051	11	10,586	760	11,346	7	13,221	981	14,202	7
	4	2,945	620	3,565	17	6,280	212	6,492	3	10,586	240	10,826	2	13,221	331	13,552	2
Cold Bay																	
	1	332	211	543	39	422	538	960	56	531	428	959	45	646	540	1,186	45
	2	332	110	442	25	422	202	624	32	531	174	705	25	646	220	866	25
	3	332	110	442	25	422	191	613	31	531	143	674	21	646	173	819	21
	4	332	103	435	24	422	129	551	23	531	132	663	20	646	162	808	20

*Less than 1 percent

1/ Using 1992 OCS population projections.
2/ Using 2011 OCS population projections.

1. South Peninsula terminal scenario.
2. St. Paul Island terminal scenario.
3. Makushin Bay terminal scenario.
4. Offshore terminal scenario.

Source: BLM OCS Office; Alaska Consultants, 1981.

population of 3,473. Although numerically large in relation to the existing population of about 1,300, the proportion of population induced by OCS operations to total population is reduced as a result of the rapid growth of the bottomfishing industry in Unalaska. Unalaska already has experienced substantial new population growth from crab processing, but the community is expected to more than double in population by 1985 and again by 1990 as a result of bottomfishing development. In this context, potential OCS-related population effects on Unalaska in numerical terms are effectively overshadowed by effects from this other sector of the economy. By 1990 and thereafter, OCS-induced population would account for less than 5 percent of total population, as shown on Table IV.B.2.a.-1. The characteristics of the population in the foreseeable future are those of a boomtown, with a predominately young, unattached and male dominated population. The Native population in Unalaska, already a minority numerically due to crab processing, is expected to become even more so a minority in the future. The boomtown characteristics of the population are expected to transform in time to a more nuclear family orientation of living. Under these circumstances and considering the timing of offshore field development, OCS-related population, if resident of Unalaska, should compliment the characteristics of the community as a whole in the long-term, although the short-run developmental period may add to the already stress-inducing effects of the initial make-ready and start-up period of the bottomfish industry. That portion of the minority Native population already stressed by and in some cases perhaps marginal to the boom economy should not be affected by the incremental population growth added by OCS activities.

Conclusion: Based on the south peninsula terminal scenario, OCS-induced population could likely interact with the communities of Cold Bay and Unalaska, whereas such an occurrance is unlikely in the case of St. Paul. The probability of significant impact should interaction occur, defined as an added 30 percent component of total population at any point in time, is highest in Cold Bay, where OCS-related population could comprise almost half the population of the community over the life of the field. OCS-related population impact is reduced to less than 5 percent of total population in Unalaska over the life of the field as a function of the population effects induced by the rapid growth of the bottomfishing industry. Although the projected characteristics of the population in these two communities suggest a very unlikely probability of long-term adverse social effects occurring given the interaction, the numerical consequences remain. Consequently, it is likely that significant population impacts could result from the proposal in Cold Bay but unlikely in Unalaska and on the Pribilof Islands.

Effect of Additional Mitigating Measures: The potential mitigating measure of an orientation program may influence to an unknown extent the appreciation of oil workers of the renewable resource orientation of Unalaska and St. Paul and may encourage the settlement of Cold Bay. The program further may help to identify mutual goals among renewable and non-renewable resource development points of view, although other levels of perceived threat or opportunity may have to be resolved in time among groups and individuals. A level of appreciation of cultural differences may be achieved by the program if attention is paid to the Orthodox Aleut culture extant on St. Paul Island and in Unalaska.

Cumulative Effects: The construction to begin in 1987 of a small boat harbor on St. Paul Island conceivably could facilitate the establishment of bottomfishing and processing operations on the island, but would not compound OCS-related population effects, which essentially are nil. The small boat harbor construction and airport expansion projects planned for Unalaska in 1983 could facilitate bottomfishing development as well as increase the short-term population impact of offshore support operations in Unalaska. Airport expansion at Unalaska also could induce the consolidation of offshore transportation support functions, thus reducing the potential for population impact at Cold Bay. The construction of a new village at Chernofsky in 1984 could compound the short-term population effects in Unalaska, since the transport of personnel and materials likely would be staged out of Unalaska. The onshore population effects of other Federal offshore lease sales in the Bering Sea on the communities in question should be marginal, since the onshore transfer and processing facilities developed for sale 70 could be used for such sale areas without significant expansion (Tremont, 1981). The effects of the state onshore lease sale in Bristol Bay may be to increase population effects incrementally in Cold Bay as a function of increased processing capacity needed at the south peninsula terminal site.

Unavoidable Adverse Effects: The size and characteristics of OCS-related population may produce short-term unavoidable stress among the populations of Cold Bay and Unalaska. Introduction of such population in Cold Bay could be perceived as reinstituting a transient character to the community, a tendency which is gradually being overcome. OCS-related population in Unalaska would contribute incrementally in the short-term to the tensions posed by boomtown conditions.

b. Impacts On Subsistence: Subsistence as a cultural orientation of Aleut villages is described in Section III.C.4. The local use for subsistence purposes of locally available and preferred renewable resources by the residents of villages and towns of the Aleutian-Pribilof Islands area is discussed in Section III.C.2. The primary renewable resource base for most all communities was examined in terms of subsistence resources locally used and the characteristics of the subsistence harvest. Maps (Figs. III.C.2.-1, -2, and -3) were provided to show the array of species used and the general locations and ranges of mobility exercised for the subsistence catch. The range of mobility is referred to here as a subsistence range. The species and mapped data should be considered indicative, as opposed to absolute, since it was based on information for only one point in time.

Local availability of and access to specific renewable resources is subject to change with changes brought about naturally and in a more contrived way by the works of man. Subsistence living involving the local use of renewable resources can be viewed as an adaptive, strategic process when considered in the context of human behavior founded on knowledge of natural phenomena in familiar environs. When familiar environs are changed or the more remote habitats of the species caught locally are changed, then local human adaptive processes are conditioned less by biological knowledge than by social, cultural, demographic and economic considerations. For the purpose of this impact assessment, please refer to Section IV.B.1. for the assessment of impacts on biological populations and habitats. The focus of this analysis is on the localized subsistence resource catch environs mapped in Section III.C.2 in terms of risks from population concentrations and oil pollution events.

(1) Population Effects: Population effects from the south peninsula terminal scenario essentially would occur in Unalaska and Cold Bay, as discussed in Section IV.B.2.a. In Unalaska, the potential effects of

bottomfishing industry population on Unalaska subsistence, as discussed in Section III.C.2.c., far overshadow the potential effects of OCS-induced population resulting from added demand for subsistence resources. OCS-induced population constitutes less than 5 percent of total population in Unalaska over the long-term life of the field. Based on this proportion, the added amount of OCS-induced population may contribute to an incremental but not substantial change to the effects on subsistence produced by the non-OCS case.

The largest increment of total population contributed by OCS-related population is achieved in Cold Bay, where OCS activity contributes 30 percent of total population in the near-term and 45 to 55 percent of population over the life of the field. Under the south peninsula terminal scenario, Cold Bay could reach a population of somewhat less than 1,200 by the year 2000. Although subsistence data are unavailable for Cold Bay, it is reasonable to assume that a certain amount of hunting, fishing, and gathering is carried on by Cold Bay residents. Assuming the resource base is comparable to that in the vicinity of Unalaska, the added population from OCS activities should not appreciably affect subsistence in Cold Bay, since a comparable population size has been achieved to date in Unalaska without substantial reduction in access to subsistence resources (see Kish Tu Addendum No. 3, 1981).

(2) Oil Pollution Effects: The oilspill risk analysis performed for the proposed lease sale is discussed in Section IV.A.4., with more complete results contained in Appendix E. Maps showing the location of land and (model) boundary segments as well as the spill points used in the analysis are provided. Table IV.B.2.b.(2)-1 contains the portion of the results pertaining to those land and boundary segments chosen as representative of the general ranges of village subsistence harvest. The data shows the probability of one or more spills of equal to or greater than 1,000 barrels occurring and contacting these land and boundary segments over the expected production life of the proposed lease sale area using four different potential transportation scenarios for carrying product to market. This discussion is based on the south peninsula terminal scenario. Effects on subsistence from the other scenarios are discussed in Section IV.B.7. The probability of spills occurring and contacting specific land and boundary segments are expressed in low, medium, and high risk factors, corresponding to ranges of probabilities.

Under the south peninsula terminal scenario, a low risk from oilspills to the Pribilof Islands exists within 10 days but is absent within the critical 3-day period, time normally insufficient to mobilize offshore cleanup efforts or dissipate toxic hydrocarbon fractions. The conditional spill probabilities for spill points 3 and 5 indicate the low 10-day risk probability could be produced from the northern blocks of the lease sale area. Based on the geography of the subsistence catch (Fig. III.C.2.-1), there may be greater vulnerability to a spill on St. Paul Island than on St. George, primarily due to the locations of the respective villages and the consequent subsistence catch patterns. Although St. Paul Island is at a greater distance from the proposed sale area, the subsistence catch predominately takes place on the southern and eastern sides of the island. The catch on St. George takes place predominately on the northern reaches of the island. This pattern is particularly true for catching fur seal in the summer and sea lion and halibut during the winter.

Table IV.B.2.b.(2)-1

Probability of One or More Spills of Equal to or Greater Than 1,000 Barrels Occurring and Contacting Land or Boundary Segments Over the Expected Production Life of the Proposed Lease Blocks Using Different Transportation Scenarios

PROPOSAL

TRANSPORTATION	SCENARIO:	A			B			C			D		
COMMUNITY	SEGMENT	3	10	30	3	10	30	3	10	30	3	10	30
St. George	38		L	L	M	M	H		L	L		L	L
St. Paul	39		L	L	M	M	H		L	L		L	L
Nikolski*	1						L	M	H	H			L
Unalaska	2								M	M			
Akutan	3							L	M	H			
False Pass	6			M			M			M			H
Nelson Lagoon	9			M			L			L			L

SCENARIOS:

A: Pipeline to Ikatan.
B: Pipeline to St. Paul, transport via Unimak Pass.
C: Pipeline to Makushin Bay, transport via Akutan Pass.
D: Offshore loading, transport via Unimak Pass.

RISK FACTOR:

L:	Low	0-10 percent
M:	Medium	11-20 percent
H:	High	greater than 20 percent

*NOTE: Segment 1 is used as a surrogate for Nikolski, the midpoint of whose range is approximately 75 miles southwest from the model boundary.

Source: BLM OCS Office.

Oilspill risk is absent for the villages of Nikolski, Unalaska and Akutan west of Unimak Pass, according to the oilspill risk analysis. Such risk is also absent within 10 days for the villages of False Pass and Nelson Lagoon east of Unimak Pass, although a medium probability of oilspill risk exists within 30 days of a spill. Such effects are compounded by the potential localized effects, such as from ballast treatment discharges and chronic (small, cumulative) spills, resulting from terminal operations. Although such effects are speculative, the area between False Pass and Cold Bay, which contains three of the most likely terminal sites, would appear most vulnerable to whatever risk may be posed by facility siting and pipeline and vessel transportation of product to and from the terminal. Within this area, the subsistence range of the village of False Pass (not mapped but assumed localized for marine resources) would appear most at risk, considering the shallow nature of the Pass and its vulnerability to offshore as well as terminal effects. Subsistence fishing emanating from Cold Bay could be affected by a terminal sited near the bay. The concentration of risk in this area of the Alaska Peninsula also could affect to an unknown extent commercial and subsistence resources used by villages elsewhere in western Alaska, such as the Bristol Bay and Kuskokwim River salmon that migrate through False Pass.

The subsistence range of King Cove (see Fig. III.C.2.-3) could be affected by tankering from any of the three westernmost candidate bays, and probably most directly by a facility sited on Cold Bay. A terminal sited on Pavlof Bay could pose risks from tankering to Sand Point as well as King Cove. The subsistence ranges for both villages generally are fairly extensive, due largely to the size of vessels in the resident fishing fleets. Within these general ranges, the subsistence resouce catch areas are either intensively site specific or extensive as a function of commercial fishing livelihood. (See Sec. IV.B.2.c. for a discussion of fishing options for these villages.) It would appear that a wider range of subsistence resource catch options are available to these villages should specific catch areas be affected by oil discharge than to the smaller fishing villages located on the north Alaska Peninsula.

The analysis in Sections IV.B.1.a.-c. (biological impact assessments) indicate an unlikely probability of significant impacts to the populations of subsistence species over the life of the field, although localized short-term effects are acknowledged. On the Pribilof Islands, short-term effects to fur seals from an offshore oilspill event could reduce the total meat supply to Pribilof Islands residents by 30 to 50 percent for as many years as the effects persisted. Short-term effects could include direct mortality of a portion of the population, but unknown effects potentially could be more critical to subsistence if such unknowns were interpreted by the resource managers (NMFS) to require the termination of the fur seal harvest altogether for the period of time necessary to study the behavior of the species. Termination of the commercial fur seal harvest already has been experienced on St. George Island, where the fur seal population of the island is used as a control group by the resource managers to measure the effects of the commercial harvest on St. Paul Island. A subsistence harvest of 350 fur seals has been allowed for St. George residents during this period, amounting to approximately 2 fur seals per capita annually for the 160 residents of the island. Using this proportion, although considered inadequate by St. George residents (see Sec. III.C.2.), an annual subsistence harvest of approximately 1,400 fur seals would be required to meet the subsistence needs of local residents, assuming a forecasted population of 525 for St. Paul and 175 for St. George. If a subsistence harvest of this magnitude were not permitted on the islands, then the proportionate reduction in meat supply could be realized. Substitution of halibut, bird or sea lion could take place in such an event, but other factors could intervene. The timing of other resource harvest may not coincide with subsistence need, the quantity of meat to be substituted may pose additional subsistence effort and resource management problems (such as with birds), the resource may not be as plentiful (as in the case of sea lion), or the resource already may be used extensively for commercial and subsistence purposes, as currently the case with halibut.

Impacts to marine subsistence resources in the False Pass and Nelson Lagoon areas could be localized to an unknown extent for the array of resources used locally (see Sec. III.C.2.). Mobility options to attain substitute or alternate subsistence resouces would be greater for these mainland residents, however, than for residents of the Pribilof Islands. Elsewhere, western Alaska fishermen could be impacted with a fisheries closure if a significant number of locally caught salmon were tainted as a result of an oilspill at False Pass. Such a closure could be instituted by state resouce managers to avoid the production of an unmarketable commodity. However, such an event would effect commercial fishing more so than the local subsistence catch, although it is unknown whether tainting would effect the ability to consume the resource locally. It is unlikely that such would be the case.

Conclusion: Significant impacts, defined as primary subsistence resources unavailable for a limited duration, to local subsistence resources from OCS-induced population are unlikely in Cold Bay, Unalaska, and the Pribilof Islands. Short-term interaction of subsistence resources with the effects of offshore oilspill incidents are likely on the Pribilof Islands, very unlikely west of Unimak Pass and unlikely east of Unimak Pass, although terminal operations on the south peninsula could increase the likelihood of local interaction there. The probability of significant impacts to subsistence is likely on the Pribilof Islands should interaction occur, given the scientific management of the fur seal population, to an extent of possibly reducing meat supply by 30 to 50 percent. Consequently, there is a likely probability of significant impacts to subsistence over the life of the field on the Pribilof Islands and an unlikely probability elsewhere.

Effect of Additional Mitigating Measures: The potential mitigating measure of an orientation program and the suggested Information to Lessees on bird and marine mammal protection may reduce to an unknown extent the probability of short-term adverse interaction.

Cumulative Effects: The construction to begin in 1987 of a small boat harbor on St. Paul Island could effect subsistence resources on the island through habitat modification, but such effects would not compound OCS-related effects, which essentially should be nil. The small boat harbor construction and airport expansion projects planned for Unalaska in 1983 likewise could effect the availability of subsistence resources through habitat modification and depletion, but such effects would be associated less with OCS activities than with bottomfishing industry development. Other Federal offshore lease sales in the Bering Sea could increase the risk to subsistence resources north and south of the Alaska Peninsula through increased tankering activity either through Unimak Pass or from a south peninsula terminal. Effects of the latter could be compounded should an onshore oil discovery in the state Bristol Bay lease sale area produce added product to be transported from the south peninsula terminal.

Unavoidable Adverse Effects: Terminal construction could unavoidably effect subsistence resources in the short-term on the south side of the Alaska Peninsula, although long-term adverse effects are unlikely. Construction of the marine support base and supporting social infrastructure in Unalaska could likewise unavoidably reduce the availability of local subsistence resources through habitat modification and depletion, although such effects should be marginal to the effects induced by the bottomfishing industry. Should subsistence resources be lost or damaged through an oilspill incident attributed to OCS operations, mitigation of such effects could be sought through the Offshore Oil Pollution Compensation Fund established in Title III of the OCS Lands Act, as amended.

c. Impacts on Fishing Village Livelihood: This analysis assumes the commercial salmon fishing livelihood of the villages of False Pass, Nelson Lagoon, King Cove, and Sand Point may be affected by the geography and intensity of oil and gas production, processing, and transfer (see Sec. IV.B.1.a. for the biological assessment of impacts on specific fin and shellfish fisheries). The discussion focuses on salmon fishing, although it is recognized that the catching and processing of shellfish is integral to the year-round livelihood of King Cove and Sand Point. The principal salmon catch areas for the north and south sides of the Alaska Peninsula shown on Figure III.C.4.-1 are the geographic basis for the discussion. Based on the discussion in Section III.C.4, the following factors for analysis were established:

1. Most salmon fishing in the Alaska Peninsula-Aleutian Islands management area is done by local, rural Alaska residents (Table III.C.4.-2), the majority of whom reside within the management area. The major exception is in drift gillnet fishing by non-residents of Alaska, who are assumed primarily to fish Catch Area A near Port Moller.

2. Of the four villages under consideration, residents fish for salmon within the Alaska Peninsula-Aleutian Islands management area; there are only a few exceptions.

3. The salmon catching gear (and the characteristics of the resident fleets) varies by community, by type, and importance (Table III.C.4.-1).

4. Most salmon are caught in specific catch (statistical) areas. The 1978 catch statistics are assumed representative of these areas, although it is recognized that the yearly significance of the catch by area potentially is variable depending on the strength of specific salmon runs.

5. Income effects to fishermen cannot be derived from the data.

Based on the results of the oilspill risk analysis, the potential for risks from oilspills (of equal to or greater than 1,000 barrels) to fishing areas A (near the Nelson Lagoon/Port Moller area) and B (near False Pass) on the north side of the Alaska Peninsula exists within 30 days of a potential spill but not within the more critical 3- or 10-day periods. (Area A is represented by land segments 9 and 10; Area B by segments 6 and 7.) The Nelson Lagoon/Port Moller area (area A) has a medium to low probability of risk within 30 days of a potential spill, whereas the False Pass area (area B) has a medium probability of 30-day risk.

If area A were affected by a spill during the critical fishing and escapement periods (see biological assessment, Sec. IV.B.1.a. for the likelihood of interaction), impacts could be expected on the livelihood of Nelson Lagoon, King Cove, and Sand Point. Nelson Lagoon would be most directly affected since most all drift and set gillnet fishing is localized. Much less productive drift and set gillnet fishing sites further north within the management area (for which limited entry permits are valid) could be sought by Nelson Lagoon residents as alternative fishing sites if less affected by the spill. Area C, the other major gillnet fishery (on the south side of False Pass), also could be sought as an alternative fishing site, based on vessel capabilities in Nelson Lagoon; but the fishery may have been likewise affected by the spill incident through the transport of oil through the shallow waters of False Pass. King Cove and Sand Point drift gillnet fishermen (44 and 24% of locally owned permits, respectively) could be affected to a comparable degree, since areas A and C are the principal drift gillnet fisheries in the management area, producing two-thirds and one-third of the drift gillnet catch, respectively, for the management area as a whole. The King Cove shore-based processing facility would be affected by potential reduction in the catch from the Nelson Lagoon/Port Moller area, since a portion of the catch normally is processed in King Cove. The cold storage facility in Port Moller likewise could be affected.

As catch areas and for other reasons, it is instructive to consider contiguous areas B and C (on either end of False Pass) as a combined fishery. Beside the potential effects of a spill to area B causing effects to area C, fishing in these distinct gear type areas present different sets of potential effects to fishermen. If the purse seine area B were affected by a spill, purse seine fishermen from King Cove and Sand Point would be affected but potentially could have other areas to fish south of the peninsula (areas D-F). Effects to the fisheries on either end of False Pass, however, could place fishermen in the village of False Pass at a distinct disadvantage, based on the unique type of multi-purpose shallow draft vessels owned by False Pass fishermen. Effects from an oilspill on the village of False Pass would depend on whether effects to area B had spillover to area C, since fishermen potentially could switch fishing gear to partially compensate for a reduction in purse seine catch. The reverse also might hold if area C were affected by chronic (small, cumulative) discharges, such as from ballast treatment, from a terminal site onshore at Ikatan or Morzhovoi Bays. The other reason for treating the fisheries on either side of False Pass as one is that these are mixed stock salmon fisheries, with local stocks mixed with portions of Bristol Bay and even Kuskokwim River salmon. Effects from an oilspill at False Pass could have consequences in western Alaska far beyond the immediate impact area for subsistence as well as commercial fishermen.

The other primary catch areas south of the peninsula (areas D-F) could be affected moreso by terminal and tankering activity, based on a south Alaska

Peninsula transportation scenario, than from direct operations of the offshore field. Area D near King Cove and area F near Sand Point appear sufficiently removed from the possible terminal sites to avoid chronic pollution affects, but may be subject to effects from tanker spill incidents, the probability of which is unavailable. Area E, from which 35 percent of the purse seine catch was derived in 1978, would be subject to potential terminal and tankering effects with a terminal site in Pavlof Bay. Areas D-F are each significant purse seine areas in the south Alaska Peninsula area, accounting for 91 percent of the aggregate purse seine catch, the totality of which in the south peninsula area contributed two-thirds of the total catch for the entire management area in 1978 (derived from Table III.C.4.-3). Purse seine fishermen from King Cove and Sand Point, assuming knowledge of local waters and adequate vessel capability, could be more adaptive in choice of fishing grounds if a spill were to occur than fishermen with other gear from the other villages discussed.

In summary, the purely salmon fishing villages of Nelson Lagoon and False Pass would be more susceptible to the effects of an oilspill event than the larger villages of King Cove and Sand Point by virtue of localized fishing and the relationship between vessels and gear types owned and the proximity of comparably productive fishing grounds. A terminal sited on Ikatan Bay or on nearby bays could increase the potential for more long-term interaction over the life of a terminal project with the False Pass fishing area. Drift and set gillnet fishermen from Nelson Lagoon and False Pass and drift gillnet fishermen from King Cove and Sand Point could be most affected by an oilspill incident. In the short-term, impacts from such an incident for fishermen unable to change customary fishing grounds due to stationary or localized fishing patterns could include partial to total annual fishing income loss. The ability to maintain family investments in vessels and fishing gear could be affected by such a loss if effects were to extend over a number of years or were due to localized chronic (small, cumulative) effects. Considerable family stress and discontinuity in livelihood could result if the potential for seeking alternative fishing grounds were frustrated by existing family investments in ill-adapted fishing technology or permits for poor fishing areas.

Conclusion: Interaction of the effects of offshore oilspill incidents with salmon fishing grounds is unlikely on the north Alaska Peninsula and False Pass area and very unlikely elsewhere south of the peninsula, although terminal operations on the south Alaska Peninsula could increase the likelihood of interaction there. The probability of significant impacts to fishermen using these grounds (defined as the inability of fishermen to change customary fishing patterns to adapt to spill effects) should interaction occur is likely for drift gillnet fishermen from all four villages, set gillnet fishermen from Nelson Lagoon, and purse seine fishermen from False Pass. Consequently, there is an unlikely probability of significant impacts to fishing village livelihood over the life of the field.

Effect of Additional Mitigating Measures: The potential mitigating measure of an orientation program, and the suggested Information to Lessees on bird and marine mammal protection may reduce to an unknown extent the probability of short-term adverse interactions.

Cumulative Effects: The harbor and fishing village projects planned for Unalaska Island may offer increased fishing options for owners of large fishing vessels in the villages considered, but should have little affect on fishermen equipped primarily to use local fishing grounds. Other Federal offshore lease sales in the Bering Sea and the proposed onshore Bristol Bay state lease sale present greater potential for increased effects to village fishermen if the potential for oil and gas to be realized in the region of western Alaska increases the volume of tankering through Unimak Pass or from the south peninsula ice-free terminal.

Unavoidable Adverse Effects: Terminal construction could unavoidably affect fisheries resouces in the short-term on the south side of the Alaska Peninsula, although long-term adverse effects are unlikely. If salmon fishing grounds were affected by an oilspill, there could be unavoidable catch reductions, gear loss and time lost from fishing, although these effects could be mitigated through the Fishermen's Contingency Fund established in Title III of the OCS Lands Act, as amended.

d. *Impacts on Sociocultural Systems:* This discussion of potential impacts on sociocultural systems is based on the impacts analysis of population, subsistence, and fishing village livelihood (Sec. IV.B.2.a.-c.). Impacts to sociocultural systems are considered in the context of the projected growth of the bottomfishing industry in the region, the potential impacts from which on sociocultural systems were examined in Section III.C.4.f. The communities considered are Cold Bay, Unalaska, St. Paul and the fishing villages east of Unimak Pass as a whole.

The informal social and political structures, networks and alliances of the frontier settlement of Cold Bay could be changed to more institutionalized and formal community decisionmaking structures (see Sec. III.C.4.f.). Impacts from such change could include changes in leadership patterns, loyalties, and group alliances from which a different orientation to community growth needs and priorities could be generated. Such effects could be facilitated, given incorporation, through annexation of the south peninsula terminal, providing a tax base to accomodate community growth needs. At the same time, the characteristics of the new population in the short-term could perpetuate the unsettled character of the community, although the long-term prospect should trend toward the family-centered form of community orientation and interaction.

Impacts of a comparable nature could occur in Unalaska, although less as a function of OCS-induced effects than from the effects produced by bottomfishing industry development (see Sec. III.C.4.f.). OCS-induced effects should be marginal but complimentary to the potential boom town effects imposed by bottomfishing development. The characteristics of the population would be comparable in the main with those forecast for the long-term character of the community, although threats to renewable resource harvest could be perceived by the fisheries segment of the population. Potential dissension could arise in the community over such matters, but the likelihood of long-term, chronic conflict is unlikely in light of the resource development orientation of both fisheries and oil and gas segments of the population. Those aspects of the sociocultural systems in Unalaska already under stress from bottomfishing development may be affected by the added increment of OCS-related population but to a marginal extent.

On St. Paul Island, individual and social systems of cultural values and orientations could be affected by the proposal if OCS activities were perceived a threat to renewable resources used on the island, especially if offshore operations were visibly evident but served no perceived benefit to the island people. Due to the colonial history of the islands, tensions such as these would tend to be internalized and could result in increased incidents of suicide and other forms of individual and social maladaptive behavior. The temporary loss of subsistence fur seal resources through an oilspill incident offshore could produce additional short-term individual and family stress, severely straining traditional Aleut institutions for maintaining social stability and cultural continuity and potentially lasting far beyond the life of the incident. Although the smaller Aleut fishing villages could experience similar short-term stress from an oilspill incident, long-term change to Aleut sociocultural systems on the Pribilof Islands or on the Alaska Peninsula would depend on the relative weakening of traditional stabilizing institutions through prolonged stress and disruption, effects which are unlikely under this scenario.

Conclusion: Long-term interaction of OCS-induced effects is likely (population increase, oilspill incidents, construction projects) with the sociocultural systems of Unalaska and Cold Bay but unlikely on the Pribilof Islands. The probability of significant impacts, defined as the displacement of existing institutions of individual and social values and orientations, should interaction occur is likely in Cold Bay and unlikely in Unalaska and on the Pribilof Islands. Consequently, there is a likely probability of significant impacts to the sociocultural systems of Cold Bay and an unlikely probability elsewhere.

Effect of Additional Mitigating Measures: Changes in sociocultural systems are defined here as involving the displacement of existing institutions of individual and social values and orientations. Suggested mitigating measures would have little effect over such processes.

Cumulative Effects: The construction projects planned for St. Paul Island and Unalaska Island would contribute few additional effects to changes in sociocultural systems brought about by the growth of the bottomfishing industry. Other Federal offshore lease sales in the Bering Sea and the state lease sale in Bristol Bay could intensify the fairly dramatic sociocultural system changes expected in Cold Bay through population increases resulting from needed increases in the processing capacity and trafficking at the south peninsula terminal site.

Unavoidable Adverse Effects: There would be no unavoidable adverse effects.

e. Impacts on Community Infrastructure: Impacts on community infrastructure (that is, educational facilities, sewage, water, solid waste disposal, health and so forth) have been identified as a major scoping issue (see Sec. I.F.). In general, the community infrastructure requirements are directly related to population growth in the communities and their associated regions. See Section IV.B.2.a. for a detailed discussion of population projections for the proposal. Information for this section was compiled from Alaska Consultants report entitled, St. George Basin Socioeconomic Systems Impact Analysis, February, 1981; Alaska OCS Office Technical Paper No. 1 (Tremont), April 1981; and Sale 70 MAP and SCIMP models, May 1981.

St. Paul: Housing is not likely to experience an increase beyond the demands projected for normal growth, if development of a bay on the south side of the Alaska Peninsula occurred. The possible range of demand from low to high over the period 1983 to 2019 is 0 to 4 units. Residential land required to accommodate 4 units (a mixture of 1-2 unit family housing, mobile homes, trailers and group housing) would be approximately 0.20 hectares (0.5 acres). Adequate land is available to meet this demand.

The potential demand for educational facilities may not be beyond the predicted growth as the additional two to five students may demand one additional classroom for elementary and secondary students.

The demand for electrical power could be minimal, with a possible need for 8 to 64 kilowatts from 1983 to 2019. The existing and proposed additions to power generators on St. Paul could adequately meet this demand. Water consumption demands at St. Paul could increase form 345,290 to 2,934,965 liters (91,250 - 775,625 gal) annually. One additional 757,082 liter (200,000 gal) storage tank might alleviate any problems. The sewage system could encounter increased demands ranging from 178 to 1006 liters per day (47-265 gal per day) in the years 1983 to 2019. The existing system (with proposed modifications) may adequately handle the increase described above. Additional demand for solid waste disposal capacity could range from 1,775 to 15,089 kilograms per year (3,906-33,196 lbs/yr). This could pose an additional strain on St. Paul's existing solid waste disposal system.

St. Paul's health services are not likely to be impacted, as there is an adequate health care facility already existing and should provide adequate care until 2000. An additional physician (the standard being one physician per 1,500 people) and an additional three acute-care beds may be needed after 2000.

At a standard of one police officer per each 500 person increase, St. Paul is not likely to need an officer until mid-2000. A new fire station and an increased water capacity to 250 gallons per minute (gpm) above the normal consumption level may be needed around 2000. This is not likely to pose a major impact upon St. Paul.

Using a standard of 1.25 telephone lines per each housing unit, communication facilities would need to increase from one to five additional lines.

Unalaska: Unalaska is likely to experience moderate impacts to the community infrastructure as a result of OCS development; however, in light of the tremendous growth predicted for Unalaska associated with the bottomfishing industry, the OCS impacts may be relatively small. (All calculations are based on analyses in the years 1983, 1988, 1992, 2011 and 2019.)

Housing might experience light demand in relation to that predicted for normal growth. A range from 40 to 131 units being demanded could occur in the mid-1980's. The residential land required to accommodate 131 dwellings would be around 8 hectares (20 acres). This assumes a mixture of dwelling units to include one to two unit family housing, mobile homes, trailers, and group housing. Several smaller housing clusters may need to be built as opposed to one centrally located housing subdivision.

The potential demand for educational facilities could have a minimal impact upon Unalaska, as an average of one to two classrooms may be needed every two to three years for elementary and secondary students. This demand would not exceed that predicted for the normal growth of Unalaska.

The demand for electrical power, at a standard of 3.75 kilowatts (kw) per new person, might range from 603 to 1,425 kw. This need is less than that predicted for normal growth; however, Unalaska's existing system is not able to adequately handle existing needs, let alone projected increases such as shown above. Water consumption demands might range from 25,000,000 to 65,600,000 liters (6,600,000-17,318,400 gals) annually. This potential demand is substantially more than the need projected for normal growth. The sewage system could experience demands ranging from 9,525 to 22,483 liters (2516-5939 gals) per day. This projected demand could be greater than that projected for normal growth. The solid waste disposal demand could range from 142,905 to 337,293 kilograms (314,392-742,045 lbs) annually. These estimated projections are in line with the projections for the normal growth case.

Health services at Unalaska could be expected to experience a slight demand, with an additional physician needed around 1987 and 1992. An additional three to six acute-care beds could be needed between 1983 and 1992. The projected demand is within those projected for normal growth in the health care field.

Using a standard of one police officer for every 300 persons, Unalaska could demand an additional three to eight officers from 1983 to 2019. This potential demand is within those projected for normal development. New fire stations and additional volunteers may be needed to maintain adequate service. In addition, there would need to be the capability of providing 250 to 500 gallons per minute (gpm) of water above normal consumption for a period of 2 hours for residential fires, 1,000 to 3,000 gpm for commercial or industrial and 3,000 to 5,000 gpm for complexes such as a school with a large gymnasium. This capability does not currently exist. Using a standard of 1.25 telephone lines per each new housing unit, communication facilities may need to meet a demand ranging from 50 to 143 additional lines. This potential demand may be met if the proposed system of 1,700 additional lines is completed in the mid-1980's.

Cold Bay: Cold Bay could experience substantial impacts to their community infrastructure due to the high numbers of OCS workers that are likely to shuttle through Cold Bay. The lack of a formal governmental group to oversee development makes the additional demands in service more severe than would normally be expected. (All calculations for the following infrastructure items are based on analyses in the years 1983, 1988, 1992, 2011, and 2019.)

Housing demands in Cold Bay could be expected to range from 30 to 189 units (a mixture of one to two family units, mobile homes, trailers, and group housing). A peak housing demand could occur around 1988-89. Any additional demand over 30 units is likely to put a severe strain on housing unless the companies chose to construct housing units for their employees. Residential land required to accommodate 189 units would be approximately 11.42 hectares (28.2 acres). There should be enough land to accommodate the demand, although the result may be several residential areas as opposed to one consolidated residential area.

Demands for educational facilities may not be very substantive, as educational demand is figured to be only 13 percent of the total population. The existing facilities may need to be supplemented by an additional two to three classrooms for elementary students and two classrooms for secondary students sometime around 1987-89, if a bay along the south shore of the Alaska Peninsula were chosen for OCS terminal development.

Demand for electrical power, assumed to be 3.75 kilowatts (kw) per new person, may come around 1988 and range from 877 to 3,643 kw, depending on the level of development. This potential demand would be beyond the existing and proposed capacity of approximately 1,800 to 3,400 kw, thus necessitating an additional 600 kw generator. Water consumption is likely to increase from the existing 41,450,259 liters (10,950,000 gal) annually to a range of 6,733,155 to 121,714,730 liters (1,779,375-32,165,625 gal) annually. The peak consumption of 121,714,730 liters around 1988 may require modifications to the existing distribution and storage system. The sewage system, which is already operating beyond its designed capacity of 7,571 liters per day (2,000 gals/day), could expect an increase ranging from 3,189 to 17,868 liters (578-4,720 gals) per day. If the peak did occur due to construction of a terminal on the south side of the peninsula, another sewage treatment system with a design capacity of around 15,000 liters (3,963 gal) per day might be advisable. Solid waste could range from 32,773 to 624,455 kilograms (72,252-1,376,689 lbs) per day. There may be a need for a formal collection service as opposed to the current independent collection.

Cold Bay's health service is likely to undergo a substantial impact, so that a physician may need to replace the current Public Health Service community nurse by the year 1990. If a terminal is developed on the south side of the peninsula, the demand for medical services may require an additional two or three physicians and six to ten acute-care beds.

Police protection for Cold Bay may need to be increased from the current level of zero to one or two by 1990 and one or two additional police officers in the years 1992 and 2011. Fire protection is more than adequate in terms of equipment, storage capacity and pumping capacity. The system already meets the standard of pumping 250 gallons per minute above normal waterflow conditions for a two hour period.

Using a standard of 1.25 telephone lines per each additional housing unit for communication services, Cold Bay could experience a range of 12.5 to 107.5 lines needed between 1983 and 2019. The existing system capacity of 400 lines should adequately serve the potential increase.

Conclusion: St. Paul, with development of pipeline, terminal and tankering operations out of a bay on the south side of the Alaska Peninsula, could adequately cope with the demands for four new housing units, an additional 64 kilowatts of electrical power, an additional 1006 liters (265 gals) per day for sewage disposal, one additional physician, three additional acute-care beds, one additional police officer, and a new fire stateion. Increased services would be needed to meet the demand for an additional 2,934,965 liters (775,625 gal) annually of water consumption, is 15,089 kilograms (33,196 lbs) per year of solid waste disposal and an additional five or more telephone communication lines. The probability of an interaction between infrastructure growth and oil and gas development is unlikely. The probability of a significant impact assuming there is an interaction is unlikely. The overall probability of a significant impact is very unlikely.

Unalaska's projected demands for housing units, educational facilities, sewage system, solid waste disposal, health care, police protection and communication facilities are within the projected base case range and could be adequately met. Demands for electrical power at 1425 kw; water consumption, at 65,600,000 liters (17,318,400 gals) annually and fire protection, with 250-500 gpm of water needed above normal consumption could exceed the existing capacities for the above items. The probability of an interaction between infrastructure and oil and gas development is very likely. The probability of a significant impact assuming there is an interaction is likely. The overall probability of a significant impact is unlikely.

Cold Bay is likely to experience moderate impacts to all of its community infrastructure under this Alternative. In addition to the lack of a local government agency that could oversee community development needs, demands for items such as housing, electrical power, water, sewage, health care, and police protection may be well beyond the existing conditions and normal growth projections. The probability of an interaction between infrastructure and oil and gas development is very likely. The probability of a significant impact assuming there is an interaction is very likely. The overall probability of a significant impact is likely.

Effect of Additional Mitigating Measures: Section 308 (Coastal Energy Impact Program) of the Coastal Zone Management Act may be utilized by the communities to assist in providing certain public services which the communities might otherwise be unable to finance themselves.

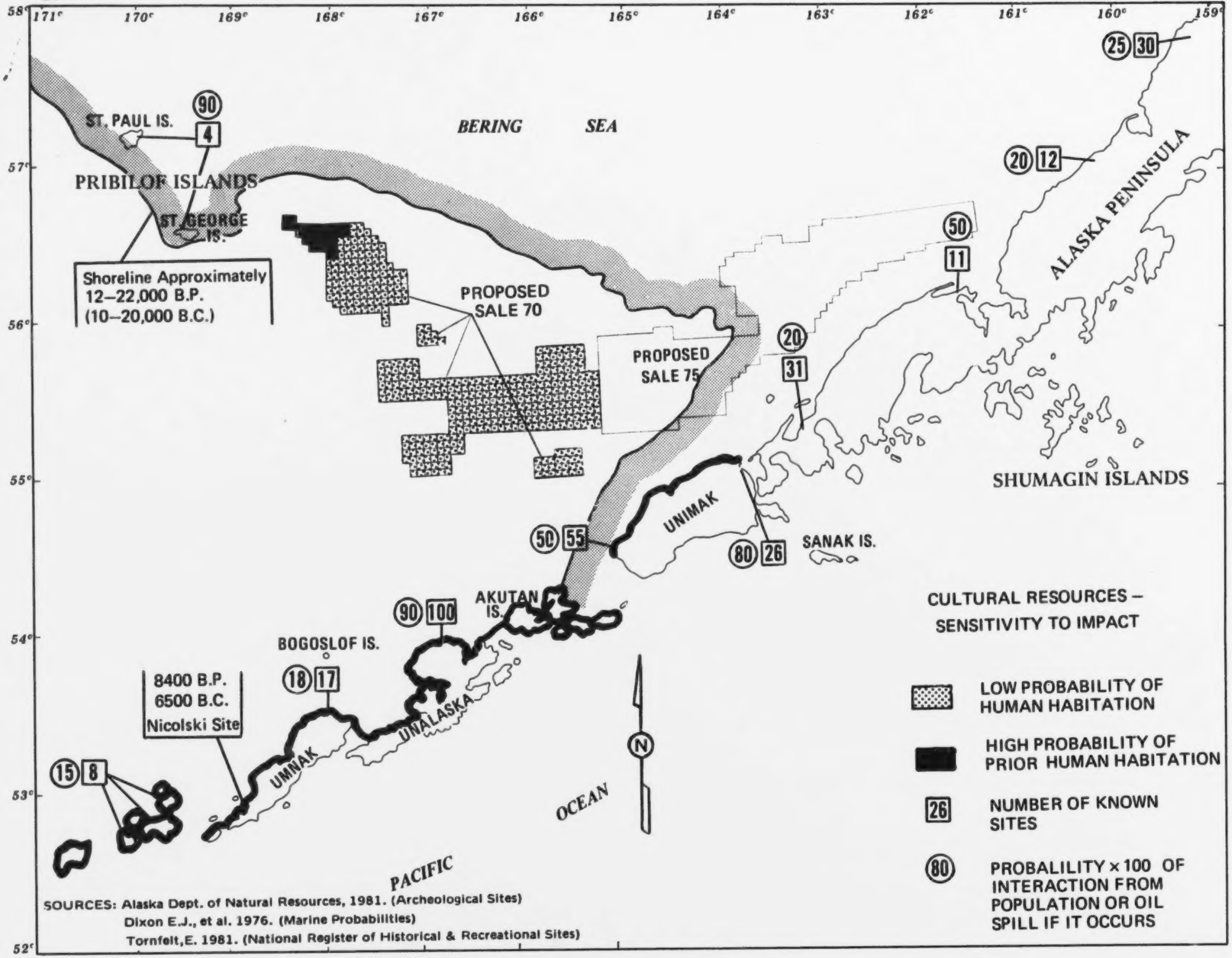
Impacts on the infrastructure for each of the communitites could be mitigated by comprehensive city and local planning, zoning regulations, and financial incentives (e.g., bonds) for improvements.

Cumulative Effects: The cumulative effect of the projects described in Section IV.A.7. would be to increase and perhaps hasten growth in the specific communities associated with each project and to the region as a whole from the proposed OCS lease sales.

Unavoidable Adverse Effects: The communities may experience difficulty in financing the increased public services demands resulting from the proposed lease sale.

3. Impacts on Cultural Resources: Impacts on cultural resources such as middens, burins, arrowheads, lamps, and other artifacts (Sec. III.D.) are most likely to occur in the 17 blocks which have high probability of human habitation, (BLM Official Protraction Diagram NO 2-8, blocks 341, 342, 385 through 390, 431 through 434, 476 through 478, 521, and 522). Preliminary exploration activities that could impact cultural resources on these blocks include coring for sediment or stratigraphic samples and dredging for rock or sediment samples. Impact from these sampling activities would be relatively slight, however, either because small areas of the ocean floor are involved or bottom disturbance is shallow. The silty sediment in the Pribilof Island area is relatively shallow compared to other continental shelf areas around Alaska.

Figure IV. B. 3. – 1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BERING SEA
ST. PAUL IS.
(90)
4
PRIBILOF ISLANDS
ST. GEORGE IS.
Shoreline Approximately 12–22,000 B.P. (10–20,000 B.C.)
PROPOSED SALE 70
PROPOSED SALE 75
(25) 30
(20) 12
ALASKA PENINSULA
(50) 11
(20) 31
SHUMAGIN ISLANDS
UNIMAK
(80) 26
SANAK IS.
(50) 55
AKUTAN IS.
(90) 100
BOGOSLOF IS.
(18) 17
8400 B.P. 6500 B.C. Nicolski Site
UNALASKA
UMNAK
(15) 8
N
OCEAN
PACIFIC
CULTURAL RESOURCES – SENSITIVITY TO IMPACT
▨ LOW PROBABILITY OF HUMAN HABITATION
■ HIGH PROBABILITY OF PRIOR HUMAN HABITATION
26 NUMBER OF KNOWN SITES
(80) PROBALILITY × 100 OF INTERACTION FROM POPULATION OR OIL SPILL IF IT OCCURS

SOURCES: Alaska Dept. of Natural Resources, 1981. (Archeological Sites)
Dixon E.J., et al. 1976. (Marine Probabilities)
Tornfelt, E. 1981. (National Register of Historical & Recreational Sites)

Hard sandy layers cover any cultural remains. It is likely that these remains would be protected to some extent by this overlying sediment. If core samples were archaeologically analyzed, resulting data would provide information useful in topographic reconstruction and archaeological site information.

During the exploration phase, air- and spark-produced explosions may be used in deep seismic work, but the potential for negative impact is not high because these devices are seldom used in areas containing high concentrations of cultural resources. Severe damage could occur to any wrecked vessels in the area from this type of activity. Most of the blocks in the area, with the exception of the ones mentioned in the beginning of the section, have low probability of human habitation (Dixon, 1976). However, the 99 blocks (Sec. II.B.1.c.) adjacent to the Unimak Pass were in the pathway of nearly every ship that went to or from the Bering, Chukchi, and Beaufort Seas and some of these ships sank in this area. Many of the ships were equipped with iron implements which could be detected with a magnetometer.

Development would cause a greater risk to cultural resources than exploration. Direct impact can occur from drilling, although the risk is slight because the drillsite is small. As the size and number of drillsites increases, so does the potential impact risk. Anchoring of the rig produces a high risk to resources because anchor disturb large areas of the seafloor if they are dragged before settling in firmly. The diameter of the affected area may be as much as 12 times the water depth, and the diameter would increase with each change of anchor location. Anchors, chains, and cables continually gouge the bottom. Anchor recovery, either by drag or by tag line and buoy, also results in bottom disturbance. Old anchor scars on the bottom are frequently seen in side-scan sonar surveys. Natural sources of gouging are not frequent in this area since the water depth is over 20 meters and heavy winter ice is seldom in the proposed sale area. Thus man-made scars, such as anchor scars or fishing trawl-door scars, are main impacts due to gouging on the bottom. Impact due to diver disturbance upon rig installation, is not likely due to the depth and danger to a diver operating in the area. The use of divers in survey work is unlikely. During the exploration period in the proposed sale area, support activities could be situated at three primary locations; Cold Bay, St. Paul Island, and Unalaska/Dutch Harbor. Cultural resources at these locations could be impacted by additional people with attendant effects such as increased use of National Historic Sites, looting of surveyed and presently unsurveyed historic and prehistoric sites. If discoveries of oil are made and development takes place, population will increase in these locations (see Sec. IV.B.2.a.). Cultural resource impact due to population increase would increase through the first 10 years, and begin to decrease after that as this basin begins to slow in production. The cultural resources of quadrangles associated with Cold Bay, Unalaska/Dutch Harbor and the Pribilofs are described in OCS Technical Paper No. 2 (Tornfelt, 1981) and Alaska Heritage Resources file (1980). The Pribilof Islands Historic District, a National Register Historic Landmark, on the Marunich Aleut Site, and the St. Peter (1887 A.D.) and the St. George (1830 A.D.) churches.

Construction of pipelines could result in adverse effects to cultural resources in blocks located in areas of low probability of human habitation (see Graphic 4) and blocks near Unimak Pass that may contain shipwrecks. Construction of facilities associated with development may also result in impacts on cultural resources on the south side of the Alaska Peninsula and Aleutian Islands. Particularly vulnerable are those cultural resources near Ikatan, Morzhovoi, Cold, and Pavlof Bays) and near Akutan Island area.

During the development and production phase potential impacts on cultural resources could result from the construction of platforms and the drilling of wellsites. Platform construction results in a great deal of bottom disturbance because of the large area of seafloor covered by the numerous pilings sunk to secure the platform base. Large magnetic gradients extending for great distances are created by the platforms, and acoustic frequencies are created that may cause noise in sonar records. Well sites may be drilled through the legs of the platforms and directly down or some distance away and connected by pipelines to the platform. Magnetic fields influencing large areas are thus created as pipelines and cables are layed between wells and platforms, platforms and adjacent platforms, and platforms and shore. Accidental debris accumulation continues around the platforms and may be accelerated with increased traffic in the area. This is particularly critical in the 99 blocks in the Unimak Pass area that may contain shipwrecks. Anchoring activities continue to disturb the bottom as tanker, work boats, and supply boats service the platform. Noise continues, as with the drillship or semi submersible, from equipment operation that could influence remote sensing records compiled for nearby areas. Rigs, helicopters, and boats are sometimes lost. As these lie on the bottom, they produce anomalies potentially masking the identification of cultural resources. Pipeline laying activities of lay barges require anchoring and dredging and debris collects along the route as the pipe is put down.

Probabilities of oilspills are discussed in detail in Section IV.A.4. The matching between oilspill probabilities of shore segments and known on-strand cultural sites could be made to assess this impact. However, because of the water dynamics, there are not many known sites left on the shore.

Oilspills are a source of potential impact on cultural resources, although there is a relatively low risk for submerged material. Many of these resources are protected from direct contamination by overlying sediment. Spill impact on marine resources would probably be in the form of contamination that would alter the appearance of small objects and/or interfere with radiocarbon dating. However, there is a relatively low risk of direct contamination. It is only the most viscous oil that is likely to reach bottom. This "tarry" oil would probably not coat the surfaces of most resources because of the protection of the sediment. Onshore resources along beach areas could be damaged by oil contamination. Cultural resources soaked by oil may not survive cleaning and restoration efforts. The identity of very small artifacts could be masked by heavy oil coating. Porous materials could be made unsuitable for carbon dating. The probability of an oil spill interacting with artifacts is unlikely and the resources affected by it are probably few. If the interaction occurs it wold likely be significant. The primary risk without a mitigating measure in place to protect onshore resources in the case of an oilspill is of cleanup damage to archaeological sites, although along most shorelines in Alaska, except Cape Krusenstern, not many sites have been found on beaches that were not already exposed to swells or waves and ice, and so moved or mixed in the soil. Construction of roads necessary to get equipment to shorelines from airports on the Aleutian Chain and the Alaska Peninsula could disturb sites farther from the shoreline. The crisis atmosphere that may result following a spill may prevent adequate surveys or marking of known sites before cleanup. The impact potential of oilspill and cleanup depends on the number of sites near the effected shore and along constructed access roads used by cleanup crews. Refer to Figure III.D.-1 and OCS Technical Paper No. 2 (Tornfelt, 1981) for site information. Oilspill and the associated cleanup activities could be considered an intrusion into spiritual and religious areas of Native Americans (See American Indian Religious Freedom Act of 1978; PL 95-341; 92 Stat. 469; 42 USC 1996). For a description of National Register Churches and Sites affected by proposed OCS sale 70, refer to Technical Paper No. 2 (Tornfelt, 1981).

The types of impacts to offshore cultural resources such as middens, burins, arrowheads, oil lamps, and other artifacts (see Table III.D.5.-1) from OCS oil and gas activity are disturbance, and/or destruction by coring, explosions in seismic work, siting and anchoring of rigs, burial by debris, masking of cultural resource magnetic gradients, and sonar returns by platforms and pipelines. Those expected onshore impacts are the oiling of artifacts, carbon-dating effects, intrusion of religious sites, wear and destruction of cultural sites, looting. The probability of interaction of oil and gas exploration with cultural resources is likely in blocks near the Pribilof Islands and Unimak Pass. It is unlikely that onshore cultural resources still remain in the high energy zone of the regions shorelines. Therefore, it is unlikely that an oilspill contacting a shoreline would encounter a cultural resource. If this interaction were to occur, it is likely that cleanup of artifacts and a site would make it difficult to retain much information and carbon-dating. Of more significance, would be the destruction of on-land sites during cleaning, road construction, and other cleanup support activities. Increased population, due to OCS support facilities and possible development activities, could likely interact with cultural resources in specific locations. Impacts are very likely to be significant, if interaction occurs. The overall probability of significant impact to marine and onshore sites is likely.

Conclusion: There would be degradation of sites containing cultural artifacts. The probability of interaction of oil and gas activity with submerged sites is unlikely and with onshore sites is likely. The probability of significant impact for both locations would be likely, if interaction took place. The final probability of significant impact for any submerged site is estimated to be unlikely. The final probability of significant impact due to increased interaction of the population with onshore cultural resources is likely.

Effect of Additional Mitigating Measures: An orientation stipulation and a cultural resources stipulation (Sec. II.B.1.c.), would reduce the probability of significant impact on marine cultural resources from likely to unlikely by reducing the number of adverse interactions. Positive impacts may occur from discoveries by survey of submerged cultural sites within the Pribilof Islands area or the finding of shipwrecks in the Unimak Pass blocks (see Table III.D.5.-1). Discoveries of cultural resources would add to our knowledge of prehistory and history. Although discoveries may be significant, the interaction is very unlikely since USGS will probably require avoidance per the cultural resource stipulation which requires avoidance of the resource as a first measure of protection.

For indirect impact on land resources, the mitigating measures would lower impacts from unlikely to very unlikely that resources will be damaged by cleanup activities. This reduction of the number of adverse impacts is due to an awareness of cultural resource location and better planning for cleanup. The orientation stipulation would help to reduce onshore site damage due to population impact. As a result, looting, increased visitation of historic sites, and spiritual intrusion on religious sites would be reduced from unlikely to very unlikely.

Cumulative Effects: Taken together with the increased sale 70 OCS population impact of the proposal on cultural resources, the proposed projects mentioned in Section IV.A.7. would result in additional impacts. Airport expansion at Unalaska would mean an increase in tourism and other businesses which, added to the OCS impact, will increase visitation to cultural resources in the area particularly the Russian Orthodox Church at Unalaska.

If Federal proposals for sales 57, 75, and 83 (Norton Sound, North Aleutian Basin, and Navarin Basin) go forward, increased tanker, work boat, and aircraft traffic would result, increasing the risk of damage and population impact on cultural resources so that significant interaction within the Unimak Pass blocks and at locations of support and development facilities would likely occur. The possible occurance of the state sale No. 41, Southwest Bristol Bay Uplands, by 1984 would increase the use of land area near the mouth of the Kuskokwim and other rivers which may include cultural resources in USGS quandrangles Baird Inlet (XBI), Goodnews (GDN), Hagmeister Island (XHI) (see Tornfelt, 1981).

Unavoidable Adverse Effects: Any accidental unplanned disturbance to a cultural site can cause dislocation of artifacts with attendent loss of information or complete destruction of the site. In most cases interaction of this kind would be unlikely. If interaction occurred, this disturbance would likely be significant. With orientation and cultural stipulations (see Sec. II.B.1.a.), this final impact would be reduced to unlikely due to a reduction in the number of unavoidable adverse interactions.

4. Impacts on Economic Conditions:

a. Impacts on State and Regional Economies: The economic impact of proposed OCS petroleum development activities is expected to be minor in areas of Alaska other than the Aleutian Islands Census Division in which the development would occur. For that reason, this DEIS does not discuss the statewide and regional economic impacts.

b. Impacts on Local Economy (Defined as the Economy of the Aleutian Islands Census Division, with Emphasis on Selected Communities): For all four scenarios, OCS employment impact in the Aleutian Islands Census Division would begin in 1983 and rise very rapidly to a peak in 1987, and drop rapidly thereafter to a 1991 level less than 30 percent that of 1987. Subsequent to 1991, employment changes would be more gradual. Estimates of the employment impacts resulting from the south side of the Alaska Peninsula scenario are presented in Table IV.B.4.b.-1.

For this scenario, employment impact would peak in 1987 at 6,399 jobs (Table IV.B.4.b.-1, Column 5). This figure would probably include about 5,610 non-

Table IV.B.4.b.-1
OCS Employment and Population Impacts
Aleutian Islands Census Division Totals[1]
(South Side of the Alaska Peninsula Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment						Residence Classification of Workers in OCS Impact Jobs			OCS Population Impact	
Year	Nonresident (Commuter) Offshore and Enclave Employment	Total Direct OCS Jobs[2]	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	All[2] Commuters	New Residents of Census Div.	Old Residents of Census Div.	Residents Only	Including Commuters with Jobs in Settled Communities
1983	269	480	14	44	538	247	291	161	86	177	199
1984	438	805	23	85	913	444	475	308	130	354	391
1985	1,036	1,608	50	150	1,808	681	1,127	548	133	657	748
1986	2,244	2,681	103	140	2,924	540	2,384	403	137	504	644
1987	5,365	5,924	250	225	6,399	789	5,610	647	142	841	1,086
1988	4,719	5,294	224	239	5,757	751	5,006	614	137	829	1,116
1989	3,793	4,484	187	281	4,952	841	4,111	708	133	991	1,309
1990	2,463	2,926	123	199	3,248	606	2,642	476	130	690	869
1991	1,096	1,538	57	180	1,775	500	1,275	372	128	558	737
1992	1,242	1,684	64	198	1,946	525	1,421	396	129	614	793
...											
2011	1,065	1,507	56	249	1,812	568	1,244	439	129	789	968
2012	538	929	31	211	1,171	454	717	328	126	590	769
...											
2019	538	929	31	211	1,171	454	717	328	126	590	769

1/ For definitions of terms used in the column headings above, see next page.

2/ Includes jobs indicated in column 1.

Source: Alaska OCS Office, 1981 (unpublished).

Definitions of terms used in the column headings are as follows:

Column (1): These figures represent OCS development jobs which are either offshore or in uninhabited locations onshore (enclaves) and are filled by workers who do not maintain a residence within the Aleutian Islands Census Division. These workers commute to residences in other regions of Alaska or out of state during periods of rest and recreation. Not included in column (1) are relatively small numbers of offshore and enclave jobs filled by workers who do maintain a residence within the census division. Workers in these jobs are included in columns (8) and (9).

Column (2): Includes all jobs in OCS petroleum development activities, including jobs filled by both residents and nonresidents of the Aleutian Islands Census Division, and jobs offshore or in uninhabited locations onshore (enclaves) as well as jobs in settled communities.

Column (3): Refers principally to those jobs not included in direct OCS employment which are created by the movement of OCS manpower and materials into and out of the area. These jobs include employment in air transportation and employment in hotels and restaurants in Cold Bay, Unalaska/Dutch Harbor, and St. Paul. Very small amounts of other types of employment are also included, such as jobs in communications services utilized in OCS activities. Not included in this category are jobs involved in transporting oil and gas to market, since these jobs are included in column (2) figures for OCS direct employment.

Column (4): Includes all jobs in retail trade, or other job classifications, which are created by the personal consumption expenditures of workers in direct and indirect OCS jobs (columns 2 and 3). Also includes government jobs, principally local government, resulting from demand for government services generated by workers in direct and indirect OCS jobs and their families.

Column (5): The sums of figures in Columns (2), (3), and (4). Also equal to the sums of columns (7), (8), and (9).

Column (6): The sums of figures in columns (2), (3), and (4) minus the figures in column (7).

Column (7): These figures represent all workers in direct OCS jobs who do not maintain a residence within the Aleutian Islands Census Division, and who commute to residences outside the census division during periods of rest and recreation. Included are Column (1) figures for nonresident workers in jobs offshore or in uninhabited locations onshore (enclaves) plus nonresident workers in jobs within settled communities.

Column (8): Includes newly arrived residents of the census division in all three categories of OCS impact jobs (direct, indirect, and induced). These workers maintain a local residence, and do not commute to other areas during rest and recreation periods.

Column (9): Includes only those workers who would have resided within the census division in the absence of OCS activity, and who become employed in OCS impact jobs, including direct, indirect, or induced.

Column (10): These population figures represent the OCS impact workers who are new residents of the census division (column 8) together with their dependents.

Column (11): Although OCS workers who commute to residences outside the census division are not considered residents, those OCS commuters whose jobs are in settled communities do have significant economic and social impacts on the communities in which they work. Figures in this column are the sums of the resident population impact figures in column (10) plus OCS commuters with jobs in settled communities. Not included are OCS commuters with jobs offshore or in uninhabited locations (enclaves) onshore. (Figures in Column 11 equal column 10 plus column 7 minus column 1.)

resident workers (Column 7) who would commute to residences outside the census division during periods of rest and recreation. Of that number, 5,365 (Column 1) would work offshore or in uninhabited locations onshore (enclaves). The only economic impact of commuters in offshore and enclave jobs would occur when these workers pass through communities within the census division (St. Paul, Unalaska, or Cold Bay) on their trips to and from residences outside the census division. However, the impact of these commuters would not be negligible, due to their large number relative to the size of the communities through which they would pass.

The jobs created by commuter travel consist almost entirely of employment in air transportation and jobs in hotels, restaurants, and drinking establishments. These jobs are included in the figures for OCS indirect employment presented in Column 3 of Table IV.B.4.b.-1. In 1987, OCS indirect employment would total 250 jobs for the south side of the Alaska Peninsula scenario.

In addition to the commuters with jobs offshore or in uninhabited locations onshore, there would be 245 commuters with jobs in settled communities in the year 1987 (difference of Column 7 minus Column 1). These commuters would have very substantial per capita economic impacts on the communities in which they work, similar to the impact of new resident workers. In addition, their commuter journeys to and from residences outside the census division would help generate increased employment in air transportation and additional jobs in hotels, restaurants, and drinking establishment in the communities through which they pass.

Other than jobs held by commuters, this scenario would result in 789 new jobs held by residents (non-commuters) in the year 1987 (Column 6). This total would consist of 647 new residents of the census division (Column 8) and 142 persons who would have resided in the census division in the absence of OCS development (Column 9). The 789 jobs held by residents include indirect and induced employment as well as direct OCS employment.

The community most affected by the south side of the Alaska Peninsula scenario would be Cold Bay. In this community the peak impact would occur in 1989 with 749 new jobs (Appendix Table G-3, Column 4) of which 206 would be filled by commuters (Column 6). Another 518 jobs would be filled by new residents who have migrated from outside the Aleutian Islands Census Division (Column 7). There would also be 25 jobs filled by new residents of Cold Bay who have migrated from other communities within the census division (Column 9). There are expected to be no OCS impact jobs filled by present residents of the community, because unemployment is virtually non-existent at Cold Bay. However, it is possible that a few Cold Bay residents would switch to OCS jobs from other types of jobs which they now hold.

At Unalaska, the peak employment impact of this scenario would occur in 1985 with about 520 new jobs (Appendix Table G-2). The vast majority of new jobs at Unalaska would be filled by new residents of the census division, and no more than 50 would be filled by current residents of the community due to the present low level of unemployment. If the bottomfish industry develops as forecasted, even fewer local residents would be available for OCS-related jobs.

At St. Paul, peak employment impact of this scenario would occur in 1987, with 37 new jobs. The OCS employment impact would provide jobs for an estimated 17 permanent residents of St. Paul, a number which is equal to 14 percent of total estimated employment at St. Paul in 1980. This small increase in jobs for permanent residents would appear to have noticeable social and economic benefits, viewed in the context of existing employment levels and rates of joblessness at St. Paul. However, if additional jobs resulting from new bottomfish activities develop as forecasted, the additional jobs in OCS activities would probably be of little or no benefit to the community (see Appendix Table G-1)

Appendix Tables G-13 through G-15 present employment projections in St. Paul, Unalaksa, and Cold Bay through the year 2000, both with and without the proposed OCS development activities.

Tables IV.B.4.b.-2 through -4 compare expected levels of employment in the Aleutian Islands Census Division with and without the proposed OCS development.

Please note that the huge employment increases in the absence of the proposed OCS development are projected on the assumption that the U.S. fishing industry will totally displace the gigantic foreign bottomfish harvest by the year 2000. Evidence of this takeover by the domestic fishing industry is negligible at this time. The assumption that American fishermen will displace foreigners in the bottomfish harvest is based on recent (1976) Federal legislation banning all foreign fish harvesting within 200 miles of U.S. coasts in fisheries where Americans have demonstrated the ability and desire to make the harvests.

If the bottomfish industry develops as forecasted, the non-OCS future of the communities of Cold Bay, Unalaska, and St. Paul will provide ample employment opportunities for residents of those communities and for residents of other communities within the census division. Consequently, from the point of view of the economic well being of permanent residents of the census division, OCS development activities would bring few benefits.

Furthermore, if the forecasted development of the bottomfish industry does not occur at the rate forecasted, or even if the forecasted bottomfish development fails to occur at all, existing and probable future unemployment at Cold Bay and Unalaska are negligible.

Conclusion: OCS development appears to offer no significant economic benefits to current residents of Cold Bay or Unalaska under any likely set of circumstances.

By contrast, the present level of joblessness is very high at St. Paul, and if the forecasted development of the bottomfish industry should fail to occur, joblessness at St. Paul would probably continue at high levels into the indefinite future. In this case, the small amounts of OCS-related employment projected for St. Paul under this scenario would be beneficial to that community.

In terms of effects on the entire census division, the probability is very likely that the proposal with the south side of the Alaska Peninsula scenario

Table IV.B.4.b.-2
Comparison of Employment Growth in the Aleutian Islands Census Division - With and Without OCS Development (Mean Case)

(OCS Employment Impacts with All OCS Commuters Excluded)

	(1)	(2)	(3)	(4)	(5)
			Projected Total Employment		
Year	Without OCS [1]	OCS South AK Peninsula Scenario	OCS Pribilof Terminal Scenario	OCS Makushin Bay Scenario	OCS Offshore Loading Scenario
1981	6,523	Same	Same	Same	Same
1982	7,383	Same	Same	Same	Same
1983	7,478	7,725	7,724	7,723	7,725
1984	7,602	8,046	8,035	8,035	8,040
1985	8,485	9,166	9,162	9,163	9,159
1986	8,718	9,258	9,255	9,256	9,237
1987	9,680	10,469	10,753	10,487	10,313
1988	10,801	11,552	11,824	11,628	11,310
1989	12,090	12,931	13,234	13,055	12,592
1990	13,727	14,333	14,568	14,453	14,043
1991	16,076	16,576	16,554	16,698	16,382
1992	17,020	17,545	17,524	17,663	17,338
...					
1995	22,539	23,071	23,060	23,191	22,863
...					
2000	31,926	32,469	32,475	32,594	32,259

1/ Employment figures for the non-OCS projections include estimates of non-wage fishermen as well as wage and salary workers.

Sources: Non-OCS employment projections were prepared by the University of Alaska, Institute of Social and Economic Research, and originally published in OCS Technical Report No. 57. OCS impact employment and population figures were prepared by the Alaska OCS Office. (See Tables IV.B.4.b.-1, -5, -6, and -7.)

Table IV.B.4.b.-3
Comparison of Employment Growth in the Aleutian Islands Census Division - With and Without OCS Development (Mean Case)

(OCS Employment Impacts - Including those OCS "Commuters" Who Work in Settled Communities)

	(1)	(2)	(3)	(4)	(5)
		Projected Total Employment			
Year	Without OCS[1/]	OCS South AK Peninsula Scenario	OCS Pribilof Terminal Scenario	OCS Makushin Bay Scenario	OCS Offshore Loading Scenario
1981	6,523	Same	Same	Same	Same
1982	7,383	Same	Same	Same	Same
1983	7,478	7,747	7,746	7,745	7,747
1984	7,602	8,077	8,073	8,073	8,077
1985	8,485	9,257	9,255	9,252	9,249
1986	8,718	9,398	9,402	9,395	9,378
1987	9,680	10,714	12,453	10,729	10,558
1988	10,801	11,839	13,768	11,911	11,597
1989	12,090	13,249	15,409	13,370	12,911
1990	13,727	14,512	16,162	14,629	14,222
1991	16,076	16,755	17,139	16,874	16,561
1992	17,020	17,724	18,109	17,839	17,517
...					
1995	22,539	23,250	23,645	23,367	23,042
...					
2000	31,926	31,648	33,060	32,770	32,438

[1/] Employment figures for the non-OCS projections include estimates of non-wage fishermen as well as wage and salary workers.

Sources: Non-OCS employment projections were prepared by the University of Alaska, Institute of Social and Economic Research, and originally published in OCS Technical Report No. 57. OCS impact employment and population figures were prepared by the Alaska OCS Office. (See Tables IV.B.4.b.-1, -5, -6, and -7.)

Table IV.B.4.b.-4
Comparison of Employment Growth in the Aleutian Islands Census Division - With and Without OCS Development (Mean Case)

(OCS Employment Impacts with All OCS Commuters Included)

Year	(1) Without OCS 1/	(2) Projected Total Employment OCS South AK Peninsula Scenario	(3) Projected Total Employment OCS Pribilof Terminal Scenario	(4) Projected Total Employment OCS Makushin Bay Scenario	(5) Projected Total Employment OCS Offshore Loading Scenario
1981	6,523	Same	Same	Same	Same
1982	7,383	Same	Same	Same	Same
1983	7,478	8,016	8,015	8,014	8,016
1984	7,602	8,515	8,511	8,511	8,515
1985	8,485	10,293	10,291	10,288	10,285
1986	8,718	11,642	11,646	11,639	11,622
1987	9,680	16,079	16,376	16,094	13,993
1988	10,801	16,558	16,891	16,586	14,232
1989	12,090	17,042	17,452	17,075	14,954
1990	13,727	16,975	17,309	17,004	15,369
1991	16,076	17,851	17,927	17,882	17,349
1992	17,020	18,966	19,043	18,993	18,451
...					
1995	22,539	24,464	24,551	24,493	23,948
...					
2000	31,926	33,816	33,920	33,849	33,298

1/ Employment figures for the non-OCS projections include estimates of non-wage fishermen as well as wage and salary workers.

Sources: Non-OCS employment projections were prepared by the University of Alaska, Institute of Social and Economic Research, and originally published in OCS Technical Report No. 57. OCS impact employment and population figures were prepared by the Alaska OCS Office. (See Tables IV.B.4.b.-1, -5, -6, and -7.)

Table IV.B.4.b -5
OCS Employment and Population Impacts
Aleutian Islands Census Division Totals[1]
(Pribiof Island Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment						Residence Classification of Workers in OCS Impact Jobs			OCS Population Impact	
Year	Nonresident (Commuter) Offshore and Enclave Employment	Total Direct OCS Jobs 2/	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	All Commuters 2/	New Residents of Census Div.	Old Residents of Census Div.	Residents Only	Including Commuters with Jobs in Settled Communities
1983	269	480	14	43	537	246	291	164	82	180	202
1984	438	805	22	82	909	433	476	318	115	366	404
1985	1,036	1,608	56	142	1,806	677	1,129	513	164	616	709
1986	2,244	2,679	112	137	2,928	537	2,391	387	150	484	631
1987	3,923	5,924	219	553	6,696	1,073	5,623	868	205	1,128	2,828
1988	3,123	5,294	171	625	6,090	1,023	5,067	853	170	1,152	3,096
1989	2,043	4,484	140	738	5,362	1,144	4,218	969	175	1,357	3,532
1990	1,147	2,926	87	569	3,582	841	2,741	685	156	993	2,587
1991	788	1,538	50	263	1,851	478	1,373	321	157	482	1,067
1992	934	1,684	56	283	2,023	504	1,519	347	157	523	1,108
...											
2011	757	1,507	48	399	1,954	612	1,342	450	162	713	1,298
2012	314	929	23	319	1,271	480	791	318	162	509	986
...											
2019	314	929	23	319	1,271	480	791	318	162	509	986

1/ For definitions of terms used in the column headings above, see footnote 1 following Table IV.B.4.b.-1.

2/ Includes jobs indicated in column 1.

Source: Alaska OCS Office, 1981 (unpublished).

Table IV.B.4.b.-6
OCS Employment and Population Impacts
Aleutian Islands Census Division Totals[1]
(Makushin Bay Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment						Residence Classification of Workers in OCS Impact Jobs			OCS Population Impact	
Year	Nonresident (Commuter) Offshore and Enclave Employment	Total Direct OCS Jobs 2/	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	All Commuters 2/	New Residents of Census Div.	Old Residents of Census Div.	Residents Only	Including Commuters with Jobs in Settled Communities
1983	269	480	12	44	536	245	291	159	86	175	197
1984	438	805	20	84	909	433	476	302	131	347	385
1985	1,036	1,608	47	148	1,803	678	1,125	539	139	647	736
1986	2,244	2,680	102	139	2,921	538	2,383	390	148	487	626
1987	5,365	5,924	262	228	6,414	807	5,607	643	164	836	1,078
1988	4,675	5,294	236	255	5,785	827	4,958	671	156	905	1,188
1989	3,705	4,484	191	310	4,985	965	4,020	822	143	1,151	1,466
1990	2,375	2,926	123	228	3,277	726	2,551	589	137	854	1,030
1991	1,008	1,538	57	211	1,806	622	1,184	488	134	732	908
1992	1,154	1,684	64	225	1,973	643	1,330	508	135	788	964
...											
2011	977	1,507	56	292	1,855	702	1,153	567	135	1,021	1,197
2012	474	929	30	242	1,201	551	650	420	131	757	933
...											
2019	474	929	30	242	1,201	551	650	420	131	757	933

1/ For defintions of terms used in the column headings above, see footnote following Table IV.B.4.b.-1.

2/ Includes jobs indicated in column 1.

Source: Alaska OCS Office, 1981 (unpublished).

Table IV.B.4.b.-7
OCS Employment and Population Impacts
Aleutian Islands Census Division Totals[1]
(Offshore Loading Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment						Residence Classification of Workers in OCS Impact Jobs			OCS Population Impact	
Year	Nonresident (Commuter) Offshore and Enclave Employment	Total Direct OCS Jobs 2/	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	All Commuters 2/	New Residents of Census Div.	Old Residents of Census Div.	Residents Only	Including Commuters with Jobs in Settled Communities
1983	269	480	14	44	538	247	291	160	87	176	198
1984	438	805	23	85	913	438	475	318	120	366	403
1985	1,036	1,608	45	147	1,800	674	1,126	539	135	647	737
1986	2,244	2,680	89	135	2,904	519	2,385	374	145	468	609
1987	3,435	3,965	157	191	4,313	633	3,680	475	158	618	863
1988	2,635	3,116	133	182	3,431	509	2,922	356	153	481	768
1989	2,043	2,573	93	198	2,864	502	2,362	354	148	496	815
1990	1,147	1,457	60	125	1,642	316	1,326	190	126	276	455
1991	788	1,098	48	127	1,273	306	967	180	126	270	449
1992	934	1,244	51	136	1,431	318	1,113	189	129	292	471
...											
2011	757	1,067	45	178	1,290	354	936	215	139	382	561
2012	314	609	24	159	792	299	493	169	131	301	480
...											
2019	314	609	24	159	792	299	493	169	131	301	480

1/ For definitions of terms used in the column headings above, see footnote 1 following Table IV.B.4.b.-1.

2/ Includes jobs indicated in column 1.

Source: Alaska OCS Office, 1981 (unpublished).

would have a significant impact in increasing the total number of jobs. However, the probability of significantly reducing joblessness is very unlikely due to the existing low levels of unemployment in most communities.

Effect of Additional Mitigating Measures: None of the potential mitigating measures are relevant to economic impacts. However, Alaska Statutes, Chapter 06, could be of value in moderating inflation of residential rental rates. This legislation is explained below in the subsection entitled "Unavoidable Adverse Effects."

Cumulative Effects: Other OCS development overlapping the St. George Basin lease offering, in terms of geography and timing, include Sale No. 57 (Norton Basin), Sale No. 75 (North Aleutian Shelf), and Sale No. 83 (Navarin Basin). There are no cumulative effects from these other OCS developments or from anticipated non-OCS developments which modify in any important way the impacts and conclusions presented above.

Unavoidable Adverse Effects: One highly probable adverse result of OCS development, even in the absence of the projected expansion of bottomfish activity in the Aleutian Islands Census Division, would be increased rates of inflation in the impacted communities. When OCS development is combined with the projected rapid expansion of the bottomfish industry, increased rates of inflation appear to become a virtual certainty due to the magnitude of the OCS and bottomfish impacts combined with the very limited number of trade and service establishments in the impacted area. Alaska Statutes, Chapter 06, Emergency Residential Rent Regulation and Control, will provide some protection to area residents. This statute authorizes the Governor of Alaska to issue a proclamation of housing emergency for any area of the state. During a housing emergency, no landlord may raise housing rents or evict a tenant except in accordance with regulations established by the Commissioner of the Alaska Department of Administration under provisions of AS 34.06. However, there appears to be no remedy for the very likely increase in rates of price inflation for commodities, including food. This could cause hardship among some area residents.

5. Impacts on Transportation Systems: This analysis focuses on the following locations: The Pribilof Islands (specifically St. Paul) Dutch Harbor/Unalaska, the Cold Bay airfield, and the bays located on the south side of the Alaska Peninsula. The scenario analyzed here has an air support base at the Cold Bay airfield, a marine support base at Unalaska, and a processing and tanker loading terminal on the south side of the Alaska Peninsula.

St. Paul Island:

Air Traffic and Airport Facilities Impacts: Assuming a facility site on the south side of the Alaska Peninsula, passenger enplanements would peak early in the exploratory period, during 1985, at less than 5 percent of the projected baseline traffic (see Tables IV.B.5.-1 and -2). By 1988, all OCS induced traffic would have ceased. In such a situation improvements to the air facilities of the island would be minimal. However, supposing that a small air facility is established at St. Paul, exploratory period helicoptor flights could be assumed to be 1.5 trips per platform per day. If it is assumed that a rough division would exist between the servicing areas of the Cold Bay airfield and those of St. Paul, the number of rigs served by the St. Paul

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Table IV.B.5.-1
Monthly Air Passenger Enplanements Expected to Result from the Proposed Action

Terminal Location	Scenario Option	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
St. Paul	Pribilof	71	115	431	1,123	4,013	3,604	2,960	1,946	716	825	963
	Makushin	71	115	269	571	1,021	786	360	79	43	79	125
	Alaska Peninsula	71	115	133	115	86	0	0	0	0	0	0
Makushin1/ 2/	Pribilof	24	35	55	104	151	153	158	85	85	85	85
	Makushin	35	35	76	176	2,098	2,087	2,115	1,509	492	492	492
	Alaska Peninsula	24	35	82	145	364	429	387	225	189	225	271
Alaska3/ Peninsula	Pribilof	420	524	894	1,555	4,336	3,106	2,763	1,672	595	742	923
	Makushin	420	524	1,150	2,890	5,546	4,184	3,202	1,843	446	593	778
	Alaska Peninsula	431	524	1,154	2,883	5,484	4,201	3,362	1,992	608	747	929
Offshore	Pribilof	108	150	401	1,032	1,098	1,662	991	596	181	217	263
	Makushin	35	36	51	102	474	423	180	82	82	82	82
	Alaska Peninsula	310	552	883	1,470	3,600	3,133	2,492	1,565	578	686	826

1/ The low commuter figures for the Makushin Bay scenario option are due to higher percentage workers being allocated as residents of the census region--specifically the town of Unalaska.

2/ Affects airfield at Unalaska/Dutch Harbor.

3/ Affects airfield at Cold Bay.

Source: BLM-Alaska OCS Office

Table IV.B.5.-2
Baseline Condition Annual Enplanements[1/]
for St. Paul, Cold Bay, and Unalaska Airports

Airfield	Type of Service	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
St. Paul	Air Carrier	3	3	3	3	3	3	3	4	4	4	4
	Air Taxi	1	1	1	1	1	2	2	2	2	2	2
Unalaska	Air Carrier	10	10	11	11	12	13	13	14	14	15	15
	Air Taxi	1	1	1	1	1	2	2	2	2	2	2
Cold Bay	Air Carrier	13	14	15	15	16	17	18	18	19	20	21
	Air Taxi	1	1	1	1	1	2	2	2	2	2	2

1/ In thousands.

Source: DMJM, 1980.

field could be two (at the height of exploratory activities) and monthly helicopter trips serving these rigs should reach 90. However, by the end of the exploratory period, helicoptor traffic from St. Paul could be expected to cease.

Impacts on Marine Traffic and Facilities: Impacts on marine facilities located at St. Paul would be slight because Unalaska would serve as the principal marine support center for the OCS activities in the St. George Basin.

Dutch Harbor/Unalaska:

Impacts on Air Traffic Facilities: OCS induced air traffic occurring at the Dutch Harbor airport during the peak of development activities, would equal one-third of the presently projected baseline passenger traffic for that terminal (Table IV.B.5.-1). Given that Unalaska will be shortly upgrading the airfield by adding a jet aircraft runway and more sophisticated navigational aids, the capability of the airport will be sharply increased. Its expanded operational capabilities should enable it to service 45 landings per hour (ERE Systems, 1981). Assuming the use of aircraft similar to the Boeing 737, four aircraft operations would be needed to throughput the entire monthly allocation of commuters projected for the peak year of activity associated with the south Alaska Peninsula terminal.

Impacts on Marine Traffic and Commerce: According to the hydrocarbon transportation scenario for the proposed action, the port of Unalaska would function as the primary marine support and supply center for both the exploratory as well as development activities. During the initial exploratory period a support base capable of servicing five exploratory drilling rigs would be established somewhere in the vicinity of Unalaska. In the exploratory period this support base would need mooring and anchorage for at least 10 support boats; however, during the developmental phase the same base would need harborage for at least twice that number. Numbers of support boats utilized as well as total number of platform trips are difficult to estimate. Normally it is assumed that each working platform (both in the exploratory and developmental stages) would require two support vessels. However, an individual operator may have more than one platform functioning, and may therefore require fewer vessels by doubling up on his platform service. Such a consideration aside, the average support boat would require 30 hours in good weather to travel to and return from the center of the proposed sale area. Considering the constraints of the area's weather, flying difficulties, and the rigorous requirements of an exploratory and development drilling schedule, such a time lag may not be acceptable and drilling operators may choose to have on hand reserve vessels in case of emergencies. Total trips per platform during the peak of developmental activities are expected to exceed 30 per month, while the field may require some 300 to 320 vessel trips per month. During the production phase, support trips are expected to decline to five trips per platform per month. In addition to facilitating the needs of supply transport, the base would also handle barges carrying bulk drilling and tubular goods. In the event of the storage of pipeline at Unalaska and the establishment of a waiting yard there, the facility would also witness a rather heavy surge of barges during the 1987 and 1988 shipping seasons (see Table IV.B.5.-3). This barge traffic would amount to one barge for every 5 days. Additional boats would be required to shuttle the pipeline from the waiting

Table IV.B.5.-3
Bulk Tonnage Transportation
Requirements for the Proposed Action[1]

	Tonnage in Short Tons				
	Pipeline[2]		Drill Casing and[3]	Mud and[4]	Transportation[5]
Year	Makushin	St. Paul	Drill String	Cement	6000 S.T. Barges
1983			3,598	5,535	1
1984			5,847	6,714	2
1985			6,746	5,915	2
1986			5,847	5,126	2
1987	369,685	278,200	23,048	2,367	66/51[6]
1988	369,685	278,200	32,580	13,786	69/54[6]
1989			24,435	20,038	7
1990			16,290	14,952	5
1991			8,552	9,560	3
1992				5,019	1
1993					

1/ This table does not include barge loads required to transport prefabricated LNG or oil terminal machinery or construction modules. These items may require a total of 10 to 12 barges spread over 3 consecutive years beginning in 1985.

2/ Tonnage indicated is the weight of the pipe delivered on site to the Lay Barge. Pipeline weight has been calculated by the USGS at 650 tons per mile for 30" oil pipe and 420 tons per mile for 22" gas pipe (USGS, 1981).

3/ Weight requirements from Northern Resource Management (1980).

4/ Mud and cement requirements from ARCO Alaska, Inc.

5/ It is assumed that transport of these bulk materials will be accomplished by larger more ocean worthy 6000, short ton barges. However, larger containerized freighters such as Sealands C 4x3 or SL180 and 25,000 and 37,000 tons respectively could be used.

6/ First figure is representative of barge requirements for a pipeline to Makushin Bay. The second represents a figure for St. Paul and is reasonably indicative of that required for a pipeline to the south side of the Alaska peninsula.

yard to the lay barges; however, such logistics would be bypassed by treating the pipe outside the sale area (Seattle) and barging it directly to the lay barge site.

The impact of OCS-related traffic on fishing vessel movements and facilities would depend entirely on the location of the support base. The location of a large marine support base close to Unalaska and its cannery facilities could result in vessel congestion and could increase the potential for vessel collision and damage. However, analysis of vessel traffic patterns reveals that by the year 2000, OCS support boat and fishing vessel collision probabilities would have increased to their maximum probable occurrence and, at that stage, collision probabilities would only occur once every 7 years or 0.14 times per year (Earl Combs, Inc., 1981). Additional conflicts could occur over use of dock space should the OCS support base fail to have sufficient moorage to accommodate all of its vessels, but these are considered unlikely because the oil industry generally seeks to construct self-contained facilities which are able to handle all required vessel activity.

Cold Bay Airfield Impact on Air Traffic and Facilities: The Cold Bay airfield would probably function as the primary conduit for all induced OCS air traffic entering the St. George region. Table IV.B.5.-1. indicates that during the peak of OCS developmental activities (1987), enplanements could approach a monthly figure of 5,500. This figure would represent an annual enplanment number of some 66,000. Such a figure would represent an increase of 3.3 times over the expected number under the baseline conditions of that year. Although this represents a dramatic increase in passengers served by the airport, it should not tax its operational capacity. The Cold Bay airfield is designed to handle 55 operations per hour (ERE Systems, 1981). Assuming that OCS passengers arriving in Cold Bay would be brought by jets similar to the Boeing 737, some 49 trips would handle the monthly projected OCS traffic. Additional facilities would have to be built to provide temporary housing and possible dining accommodations for at least the developmental phase passenger surge. Also it is probable that storage, as well as maintenance facilities would be constructed at Cold Bay for repair of OCS aircraft and storage of parishable commodities. OCS workers upon deplaning at Cold Bay would be shuttled to worksites via helicopter. These trips would average 1.5 per day per platform, at least through the developmental period. During the production phase, helicopter traffic could be considered to decline to 1 trip or less per day per platform.

Bays on the South Side of the Alaska Peninsula: The four bays located on the south side of the Alaska Peninsula which have been hypothesized for OCS terminal facility development are identified as Ikatan, Cold, Morshovi, and Pavlof Bays. At present none of these sites have adequate infrastructure for OCS activities. They would probably not be used for any OCS operations except during the construction phase when and if a large LNG or oil processing terminal might be located on the shores of one of the bays. The terminal would be connected to the Bering Sea production platforms by a trans-peninsula pipeline. Because there are deepwater, ice-free bays, tankers of the VLCC class could be utilized to transfer hydrocarbons at any one of them. The use of such a class of crude carriers would cause total tankerage from a south side terminal to reach 210 or less trips per year. The approaches to some of these bays have shoals and other obstacles which would have to be considered in traffic lane design. During the developmental period, barges would carry fuel, food, housing modules, machinery as well as the pre-fabricated units comprising the oil and gas terminals. The number of barge trips required to move these goods is difficult to estimate. Perhaps 10 to 12 barges of the 6,000 short ton class would be needed over a 4-year period. The constructed terminal complex would probably have a minimum of three berths and would probably have an attendant breakwater.

Conclusion: Air traffic increases would result in short-term impacts which should engender moderate renovations to all affected airfields. Flight operations by both fixed wing and rotary aircraft would sharply increase above the base case projected for the subject area. Impacts resulting from dock, vessel, and space-use conflicts on marine transportation systems should be intense but of a short duration and limited to the Dutch Harbor/Unalaska area. It is very likely that the transportation systems of the subject area would be impacted by the proposal and it is very likely that this impact would be significant. The overall probability of a significant impact on the transportation systems of the area as a result of the proposal could be considered as very likely.

Effect of Additional Mitigating Measures: Of the suggested mitigating measures described in Section II.B.1.c., the orientation stipulation is perhaps the most germane to the maintenance of vessel safety. Education of support boat and tanker crews and the knowledge of the fishing areas and fishing channels would do much to alleviate potential gear and vessel conflicts. Other mitigating measures beyond DOI control, such as the adoption by participating industries of a hydrocarbon transportation scheme(s) which would act to remove crude and LNG carriers from the potentially heavily traveled and biological sensitive Unimak Pass, would eliminate a risk of significant proportions.

Cumulative Effects: The forecast upgrading of the Unalaska airfield and the establishment of a new city dock and small boat harbor at Unalaska, as well as the construction of a small boat harbor at Unalaska, should be projects which will tend to lessen the cumulative effects of the proposal. Significant cumulative effects to the regions transportation systems would likely result from pending OCS sales scheduled for the Bering Sea and state lands surrounding the Bristol Bay. The assumed discovery of hydrocarbons as a result of these sales may have the following impacts on the subject transport modes and traffic densities: establishment of St. Paul or St. George Island as a forward support and supply base camp capable of handling air and sea support for Navarin OCS activities; the increase of support boat traffic from Unalaska as a result of proposed sale 75 support activities; a substantial increase in air traffic at Cold Bay which may entail a doubling of helicopter traffic (from that of proposed sale 70) emanating from the airfield; a general buildup or increase of capacity for all support facilities serving the St. George region; and finally crude oil and gas tanker shipments that would be at least three times those currently hypothesized to occur for the proposed action of lease sale 70.

Unavoidable Adverse Impacts: Unavoidable adverse impacts expected to occur as a result of this sale are as follows: Sustained aircraft traffic over areas previously only traveled by aircraft, increase in aircraft accidents, long-term increase in vessel traffic in the Unalaska Harbor and Unimak Pass regions which could lead to vessel and gear conflicts, intrusion of transportation systems into primitive areas previously not exposed to large-scale human activity.

6. Impacts on Coastal Zone Management: Impacts from the proposed lease sale on the Alaska Coastal Management Program (ACMP) can be identified and evaluated through the consistency provisions of the Federal Coastal Zone Management Act (P.L. 92-583, as amended). Technical Paper No. 4 (Casey, 1981) contains an explanation of the CZMA consistency provisions as they apply to the OCS leasing program.

Aleutian/Pribilof Island areas: The proposal, with development of a pipeline to a terminal on a bay on the south side of the Alaska Peninsula is not expected to adversely affect a potential district Coastal Management Program (CMP) for the Aleutian Islands Coastal Resource Service area northeast of Unimak Pass and the southwestern section of the Alaska Peninsula. Impacts that might occur are identified below. The Aleutian/Pribilof Islands region is just beginning to form coastal resource service area boards, and will not have state legislature approved plans for several years. If the proposed lease sale occurs in February 1983, it will have occurred before the Aleutian Islands and Pribilof Islands coastal management programs are approved by the state.

An impact could occur if OCS related activities and coastal zone planning are not compatible. Of special importance is the siting of energy facilities so as to minimize adverse environmental and social effects on the local area while still meeting basic industrial requirements (See 6 AAC 80.070 (b)(1)). Siting of OCS related facilities should be compatible with existing and future adjacent uses and projected community needs (See 6 AAC 80.070(b)(2)).

It is possible that the plans and activities generated as a result of this proposed lease sale could add an administrative burden to those in the coastal zone management agency and to state and local agencies involved in review of the federal consistency process.

It is important to realize that development of coastal zone resources for oil and gas facilities could occur in environmentally unsuitable areas before a plan is developed for the area. Federal and state coastal zone management programs are the only major form of assistance provided to local residents to mitigate the adverse effects of offshore drilling. If the lessee or agents operating in the St. George Basin are not aware of the need to coordinate the siting of energy development facilities with the coastal resource service area boards (or, if one is not formed, with agencies interested in coastal zone management), siting of facilities in an environmentally unsuitable area of the coastal zone could occur before the state legislature approves the district CMPs for the Aleutian/ Pribilof Islands region.

Also of concern to local residents is the impact of the potential bottomfishing industry expansion. Optimistic predictions regarding a large expansion of the bottomfish industry in the Aleutian region has raised local concern for stricter control of development in the region so as to prevent damage to the coastal zone resulting from industrial development (personal communication, Veronica Clark, May 4, 1981). The coastal resource service area board and its programs are seen as an effective mechanism, once implemented, to mitigate adverse impacts resulting from the bottomfishing industry.

Conclusion: The proposed lease sale may have some impact, not necessarily adverse, on the district coastal management program once it is completed.

The probability of interactions occurring between the proposed lease sale and the district CMP is likely. The probability of a significant impact occurring, assuming there is some interaction, is unlikely. The final, or overall probability of a significant impact is unlikely.

Effect of Additional Mitigating Measures: The suggested Information to Lessee regarding coastal zone management and the district CMP would assist in helping the lessee or its agents be aware of placement of OCS related facilities in areas designated as environmentally preferable for energy facilities. Local concern for coastal zone protection would also be met more readily if the lessee or its agents were aware of the need for coastal zone area protection.

The orientation program as a mitigating measure would help to promote understanding, appreciation, and careful use of the coastal areas of the Aleutian/Pribilof Islands region, and could help to recognize and address the concerns of local residents, including coastal zone impacts.

The Federal consistency provisions contained in the Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464), could also act as an effective mitigating measure, as Sec. 307 requires that actions taken by Federal agencies comply with approved state coastal zone management programs. See Technical Paper No. 4 (Casey, 1981) for a complete discussion of Sec. 307 and its requirements.

Cumulative Effects: Cumulative effects upon the district CMP in the Aleutian Islands and southwestern Alaska Peninsula are difficult to isolate because of the orientation of the state program and the absence of a completed and approved district CMP.

It is possible that expansion of the Unalaska airport could intrude into areas identified as unsuitable for development by the district CMP. Proposed OCS lease sales No. 57, Norton Basin; No. 75, North Aleutian Shelf; and No. 83, Navarin Basin could impact the CMP in that there would be additional vessel traffic through the Aleutian region, thus creating the potential for bases or transshipment points sited within the Aleutian region. These additional support bases or transshipment points, if sited in environmentally unsuitable areas, could conflict with recommendations in the district CMP. These impacts are not likely to be adverse but may be somewhat significant impacts.

Without approved district CMPs which would identify the goals and objective statements of the Aleutian region in regard to coastal zone management, it is only feasible to state that conflicts of an undefined type and intensity could occur.

Unavoidable Adverse Effects: The proposed lease sale could result in some unavoidable adverse impacts upon the district Coastal Management Program once it is completed for the Aleutian Island area.

7. Impacts of Other Transportation Scenarios: The three developmental and transportation scenarios, described below, are presented in order to analyze differences in impacts. These are presented to give the decision-

maker an understanding of the expected impacts if development siting and transportation systems were to differ from those of the south side of the Alaska Peninsula scenario.

a. Pribilof Island Scenario: The following impact analyses are based on a scenario which entails transportation of oil by pipeline to a terminal located on one of the Pribilof Islands (most reasonably St. Paul). From there, oil would be transported by tanker via Unimak Pass to an unspecified location in the contiguous U.S. Refer to Section II of this EIS for a more detailed description of this scenario.

(1) Impacts on Biological Resources:

(a) Impacts on Fisheries: This scenario poses the greatest hazard to fisheries resources. The Oilspill Risk Analysis indicates a 39-percent probability that a 1,000 barrel or greater oilspill from this transportation system contacting the Pribilof Islands within 10 days. Thus, fisheries resources near the Pribilof Islands would be at much higher risk with this scenario than with a south side of the Alaska Peninsula scenario. Oilspills in excess of 1,000 barrels reaching nearshore areas around the Pribilof Islands could contact large segments of the larval crab (blue king and korean horsehair) populations located there. The severity of impact would be dependent upon the season in which the oilspill occurred.

The risk of a tanker spill in Unimak Pass during a critical period of salmonid migration would also be higher with this scenario than with a south side of the Alaska Peninsula scenario.

Conclusion: This transportation scenario potentially has high impact on fisheries resources. The probability of interaction is likely. The impact would likely be significant, if interaction were to occur. The overall probability of significant impact is likely.

Effect of Additional Mitigating Measures: See Section IV.B.1.a.

Cumulative Effects: This scenario would not appreciably change the cumulative effects on fisheries discussed in Section IV.B.1.a.

Unavoidable Adverse Effects: This scenario does not alter unavoidable adverse fisheries impacts discussed in Section IV.B.1.a.

Impacts on Commercial Fishing: Under this transportation scenario, the pioneering commercial fishery by residents of the Pribilof Islands and the present foreign bottomfishing vessels could be subject to some conflict with OCS-related vessels. This conflict would largely entail loss of fixed fishing gear and possibly, vessel collisions; however, oilspills could affect both fishing gear and catch. Because the fishing seasons are limited by regulation and environmental and species factors, the impacts would not be year round. In addition, the Fishermen's Contingency Fund and the Offshore Oil Pollution Compensation Fund could compensate fishermen for damages resulting from OCS-related activities (see Casey, 1981).

Conclusion: A pipeline to and tanker system from the Pribilof Islands would have some impact on both resident and foreign commercial fishing vessels in the area and their fishing gear. The probability of interaction is unlikely. If interaction should occur the impact would be insignificant. The overall probability of significant impact would be unlikely.

Effect of Additional Mitigating Measures: See Section IV.B.1.a.

Cumulative Effects: These are essentially the same as discussed for the proposal (Sec. IV.B.1.a.).

Unavoidable Adverse Effects: This scenario would be more likely to impact fisheries resources than the south Alaska Peninsula scenario, but the types of unavoidable adverse effects would be the same as described in Section IV.B.1.a.

(b) Impacts on Marine and Coastal Birds:

Site-Specific Impacts: The Pribilof Islands and Unimak Pass are two major areas of bird concentration that could be affected by pipeline transport of oil to St. Paul Island and tankering to the North Pacific. Both localities are important foraging areas for nesting colonial seabirds, and Unimak Pass is utilized extensively during spring and fall migrations.

With this scenario the probability of oilspills entering the intensive use area surrounding the Pribilof Islands (Impact Zones 21-24 and 25-28) is much greater (St. George, 86%; St. Paul, 63%) than with the Alaska Peninsula scenario (St. George, 50%; St. Paul, 15%). Density of birds foraging near these islands ranges from 431 to 530 birds per square kilometer, equivalent to about 600,000 individuals at any given time. Because of the anticipated slow recovery from large scale die-off of breeding individuals contacted by oil, oilspills in this area could result in significant reduction of these large and important colonies. Likewise, disturbance from increased air traffic and human presence associated with oil and gas activities could have a severe negative effect on production by colonial species during the nesting season, adding to impacts on the populations caused by contact with oil at sea.

At risk in Unimak Pass are foraging seabirds from adjacent colonies totaling approximately 500,000 individuals during the breeding season (May-October), as well as immense concentrations of shearwaters in spring, summer, and fall. An extimated 720,000 birds are found in the pass in summer at any given time and shearwater densities of 400 to 1,000 birds per square kilometer equivalent to 1.1 million individuals have been observed in fall. Apparently the result of current structure, probability of oilspills reaching the pass (Impact Zones 9-10) is relatively low (16-24%) for both this transport scenario and the south Alaska Peninsula scenario. Likewise, proximity to the proposed sale area would result in high probability (72-84%) of oilspills entering the area surrounding Unimak Pass western entrance (Impact Zones 5-8), where seabirds from numerous eastern Aleutian colonies and elsewhere forage, migrate, or overwinter.

According to Wiens et al. (1979), a 1,000-barrel oilspill could cover as much as 455 square kilometers; at average pass density (224 birds/km^2) an event of this magnitude could result in the death of 102,000 individuals.

Conclusion: Critical areas most likely to be affected by transport of oil from St. Paul Island are the Pribilof Islands and Unimak Pass.

In the Pribilof Islands, oilspills are considered likely to enter the surrounding intensive-use zone and potentially interact with foraging seabirds during the breeding season. It also is considered likely that interaction would occur between seabirds at the nesting colonies on the Pribilof Islands and increased airplane and ship traffic, thus the probability of interaction between seabirds and the combination of oil at sea and disturbance at the colonies is likely. In view of the sensitivity to oiling of the most abundant species, and the possibility of severe disturbance impact at the colonies, interaction, if it were to occur, would likely have a significant effect. Overall chance of regionally significant seabird-oilspill disturbance interactions during the breeding season in this area is considered likely.

Interactions between oilspills and seabirds in Unimak Pass would be unlikely. If interaction occurred, impacts on major seabird concentrations would likely be significant. Probability of significant impact in the area west of the pass entrance would be more likely than in the pass itself.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as described for the south Alaska Peninsula scenario (see Sec. IV.B.1.b.).

Cumulative Effects: Cumulative effects would be the same as described for the south Alaska Peninsula scenario (see Sec. IV.B.1.b.).

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as described for the south Alaska Peninsula scenario (see Sec. IV.B.1.b.).

(c) Impacts on Marine Mammals:

Site-Specific Impacts: Location of primary loading facilities at St. Paul Island and tankering to the North Pacific could affect marine mammal populations in three areas: the Pribilof Islands (fur seal, sea lion; May-December), Unimak Pass (fur seal; April-June and October-December), and the migration corridor between the two (fur seal).

With this scenario, the probability of oilspills entering the intensive-use area surrounding the Pribilof Islands (Impact Zones 21-24 and 25-28) is much greater than with the Alaska Peninsula scenario (St. George, 86% vs. 50%; St. Paul, 63% vs. 15%). Risking contact with oil in this area during the breeding season are hundreds of thousands of nursing female fur seals (a large proportion of this population's breeding stock being in the water at any given moment) making repeated trips between the rookeries and foraging areas near the islands and southeastward. Dependence on fur rather than blubber for insulation increases the vulnerability of this species to oil contact, and were oil to reach the islands, repeated contact by females and subsequent transfer to nursing pups could seriously impact productivity for the year if they were to succumb on a large scale. Likewise, female sea lions making repeated trips to their rookeries in the islands could be adversely affected, although because of their blubber insulation they are not physiologically as sensitive to oil contact as are fur seals. Disturbance from increased air traffic and human presence may affect the fur seals breeding activities, and expanded ship traffic could have a long-term impact on movements of seals in the vicinity of the islands.

Probability of oil contacting western Unimak Pass (Impact Zones 9-10) the major Bering Sea entrance utilized by fur seals, is more likely with St. Paul loading (48%) than with the south Alaska Peninsula scenario (27%). During spring and fall migrations much of the breeding population would be at risk while traversing this area. Beyond the west entrance (Impact Zones 5-8) where females frequently forage, probability of contact is high regardless of transportation route used, 84 percent (St. Paul) and 72 percent (south Alaska Peninsula). Long-term effects from potential ship traffic disturbance in the pass during migration remain unknown.

Probability of oilspills from the proposed sale area entering Impact Zones 14 through 17 in the area between the Pribilof Islands and Unimak Pass, through which the fur seals travel twice each year, ranges from 35 to 65 percent, slightly greater than for a south Alaska Peninsula scenario (29%-60%). However, since the actual disturbance of fur seals in this corridor during migration and foraging trips is poorly known, it is difficult to relate oilspill contact probability to probability of interaction or degree of impact on the population. Similarly, probability of contact along the shelfbreak (Impact Zones 19-20), where many fur seals may migrate or forage, ranges from 25 to 42 percent, well above the risk to this area by a south Alaska Peninsula scenario (4%-23%), but lack of precise distributional data precludes any rigorous interpretation of contact probability and likelihood of significant effect. Transport of oil from St. Paul Island intensifies the threat of oilspill impact to important foraging areas near the Pribilof Islands and does not significantly decrease the possibility of industry activities causing alteration of traditional foraging and migration routes between the Pribilof Islands and eastern Aleutian passes. Spotted and ribbon seals occur in the ice front (Impact Zones 29-35) in spring (February-April); the extent to which they are found in the proposed sale area is determined by the extent of ice advance. Prevailing direction of simulated winter oilspill trajectories is southwest, hence, probability of contact in this region is very low, not exceeding 8 percent, suggesting that oil interaction with these species is very unlikely.

Conclusion: Critical areas most likely to be affected by transport of oil from St. Paul Island are the Pribilof Islands and Unimak Pass. This transportation scenario would place the fur seal at greatest risk by concentrating industry activities where the population is most vulnerable, on and around the Pribilof Islands during the breeding season.

In the Pribilof Islands, oilspills are considered likely to enter the surrounding intensive-use zone and potentially interact with foraging or migrating fur seals. The possibility of disturbance impact also exists. Sensitivity of fur seals to oil contact suggests that significant impacts are likely from contact with oilspills, and contact with a large proportion of the breeding stock could have significant effect on the Pribilof Islands population. Overall chance of significant fur seal-oilspill/disturbance interaction during the breeding period in this area is considered likely.

Interaction between oilspills and fur seals in Unimak Pass is considered unlikely; however, spills occurring in this area during the period when pregnant and other breeding females are passing through are likely to have a significant effect on the population. Overall, probability of significant impact is more likely in the area west of the pass entrance than in the pass itself where it is considered unlikely.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as described for the south Alaska Peninsula scenario (see Sec. IV.B.1.c.).

Cumulative Effects: Cumulative effects would be the same as those described for the south Alaska Peninsula scenario (see Sec. IV.B.1.c.).

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as described for the south Alaska Peninsula scenario (see Sec. IV.B.1.c.).

(d) Impacts on Endangered Species: Risk of oilspills affecting the outer Unimak Pass region (hypothetical targets 5-8) associated with leasing of the entire proposed area and this transportation mode would be at 15 to 56 percent (Appendix E, Table 21) and 23 to 24 percent for the inner Unimak Pass region (Appendix E, Table 21, hypothetical targets 9-10). These levels exceed those discussed for the proposal and pipeline transportation to the Alaska Peninsula (7-41% and 0-16%, hypothetical targets 5-8 and 9-10, respectively). However, the risks to the Unimak Pass area associated with this transportation mode are less than would be incurred under a pipeline to an Aleutian Island (see Appendix E, Table 22 and Sec.IV.B.7.b., below) or if offshore loading would occur (see Appendix E, Table 31 and Sec. IV.B.7.c.).

As a result of a pipeline terminus at the Pribilofs, greatest increases in risk would occur in offshore areas near St. George and St. Paul Islands; levels of risk of spills moving towards St. George Island would be as much as 56 percent (Appendix E, Table 21, hypothetical targets 22-24) as compared to as much as 29 (Appendix E, Table 20, hypothetical targets 22-24) if oil were piped towards the Alaska Peninsula. The risk levels associated with this transportation made to offshore areas perimetering the Pribilofs are the greatest of any transportation mode (compare to risk levels to Hypothetical Targets 22-27, Appendix E, Tables 22 and 31). Therefore, risks of direct or indirect effects of oilspills (see Sec. IV.B.1.d.) to endangered cetaceans and birds and non-endangered cetaceans would be higher in the Unimak Pass migratory corridor and in the vicinity of the Pribilof Islands as a result of this mode of transportation although other modes may pose greater oilspill risks to the Unimak Pass region. Although probability of interaction of whales or their habitat and oilspills could be expected to increase proportionally, the probability of significant oil-spill related effects on endangered cetaceans would be essentially the same as discussed in Section IV.B.1.d. Movement of tankers through the Unimak Pass region may increase noise levels in the area. However, since the pass already is a major vessel route, it is difficult to estimate the significance of such noise increase. Nevertheless, this mode of transportation may increase the probability of localized disturbance effects on endangered and non-endangered cetaceans.

Conclusion: Same as proposal.

Effect of Additional Mitigating Measures: See Section IV.B.1.d.

Cumulative Effects: See Section IV.B.1.d.

Unavoidable Adverse Effects: See Section IV.B.1.d.

(2) Impacts on Social Systems:

(a) Impacts on Population: OCS-induced population would be 48 percent less (110 vs. 211) in Cold Bay by 1985 as compared to the south peninsula terminal scenario, and approximately 60 percent less in the long-term as measured in 5-year increments to the year 2000. OCS-related population would comprise 25 to 32 percent of total population during this period as opposed to about half the population of Cold Bay under the south peninsula scenario. In Unalaska, OCS population would be reduced over the life of the field to approximately 85 percent less population than under the south peninsula scenario. The 1985 OCS population would constitute 11 percent as opposed to 15 percent of total population in Unalaska, whereas the long-term contribution of OCS population to total population would be reduced from less than 5 percent to 1 percent or less.

In contrast with these communities, population effects on the Pribilof Islands from this scenario must be examined directly rather than comparatively, since the effects essentially were nil under the south peninsula terminal scenario. On St. Paul Island, OCS-related population would account for 27 percent of the total population (197 of 722) in 1985 and 37 percent (827 of 2,250) in 1990, with a reduced proportion thereafter. Timing of events is an important factor in this scenario, since an onshore bottomfish processing plant (and perhaps a small boat harbor) should be under construction at about the same time in order to be operational by 1990. The size of the construction work force needed to build the plant is unavailable. Regardless, when the bottomfish fishing and processing operations are on line in 1990, population from this sector of the economy is anticipated to account for 40 percent (898) of the total population, with OCS facilities contributing 37 percent of total population, as indicated earlier. The traditional village, which potentially could be most affected by industrial development on the island, would comprise 23 percent (525) of the total population in 1990 and somewhat more than 25 percent of total population by 1995 and beyond. Potential impacts from the population attributed to bottomfishing (a population constant of 898) are assumed mitigated through enclaved physical facilities and specialized hiring practices, as discussed in Section III.C.4.f. Bottomfishing-related population is anticipated to comprise about half the population on the island through 2000. Holding constant the potential effects from bottomfishing population, OCS-induced population could outnumber village residents in the near-term and be about equal to village population in the long-term through 2000. The effects of such a relationship could completely change the character of the community of St. Paul (see Sec. IV.B.2.d., Sociocultural Systems).

Conclusion: The probability of significant impact should interaction occur, defined as an added 30 percent component of total population at any point in time, is highest on the Pribilof Islands, where OCS-induced population in the long-term could equal the resident Aleut population, as shown in the case of

St. Paul. Population increases in Cold Bay would be reduced by approximately 50 percent yet comprise from 25 to 32 percent of total population over the life of the field. OCS-induced population in Unalaska would contribute 1 percent as opposed to 5 percent or less of total population over the life of the field. The probability of significant population impacts from the proposal is very likely on the Pribilof Islands, likely in Cold Bay, and unlikely in Unalaska.

Effect of Additional Mitigating Measures: Same as with Alternative I.

Cumulative Effects: Construction of a small boat harbor on St. Paul Island in 1987 could add to the short-term construction period impact of an OCS terminal facility built on the island. The effect of the state onshore lease sale in Bristol Bay may be to encourage additional terminal facilities in the area, such as the south peninsula site. Otherwise, cumulative effects are the same as with Alternative I.

Unavoidable Adverse Effects: Same as with Alternative I for Cold Bay and Unalaska. In the case of St. Paul (or St. George), the resident Aleut population could become a minority in the context of OCS terminal operations combined with ongoing bottomfishing activities. The individual and social stress associated with such status could produce maladaptive behavior among the resident Aleut population unavoidable within the authority of the Department of the Interior.

(b) Impacts on Subsistence Patterns: Population effects on subsistence resources should be the same as described for the south side of the Alaska Peninsula scenario in Cold Bay and Unalaska. As discussed in Section IV.B.7., this scenario produces the largest increment of OCS-induced population increase in St. Paul, an increase which comprises a smaller proportion of total population than that generated by bottomfishing operations. Potential effects on subsistence resources from OCS-related population increase should be minimal, not only as a function of population size in relation to bottomfishing-induced population but also by the nature of the resources available on the island for subsistence purposes. Salmon, trout, and other customary game fish are not available on the island. In addition to the managed fur seal harvest, marine mammals (seal, sea lion) are hunted as opposed to other game animals, which likewise are not generally available. With the possible exception of migratory ducks and geese and other waterfowl, the lack of customary game species on the island should substantially reduce potential conflicts in the use of resources for subsistence purposes.

Oil pollution effects potentially are greater for the Pribilof Islands by this scenario, with risk factors increased from a low 10-day probability of interaction to a medium 3-day probability. Elsewhere, the pattern of risk is the same as or comparable to that described in Section IV.B.2.b., with the exception of Nikolski. Nikolski is exposed to a low probability of risk within 30 days, using boundary segment one as a surrogate for the Nikolski subsistence range, the mid-point of which is approximately 75 miles distant from the boundary segment in a southwesterly direction. Although the risk to Nikolski is speculative, due to its distance from the potential oilspill hazards, the subsistence harvest appears vulnerable to disturbance due to the geography of the catch. Nikolski Bay and Sandy Beach are the principal staging areas for the subsistence harvest during the summer months, but the Nikolski reef and lagoon system is depended on year round for resource harvesting by all age groups in the village. The village itself is more vulnerable than others in the area to a disturbance of the natural environment since the economy is based on subsistence.

Conclusion: The likelihood of significant impacts to local subsistence resources from OCS-induced population is the same as described for the south side of the Alaska Peninsula scenario. The interaction of subsistence resources with oilspill incidents on or near the Pribilof Islands is very likely considering the 3-day medium risk factor posed by this scenario. Elsewhere, the probabilities of interaction are comparable to those outlined for the south side of the Alaska Peninsula scenario (see Sec. IV.B.2.b.). The probability of significant impacts (primary subsistence resources unavailable for a limited duration) to subsistence on the Pribilof Islands should interaction occur is the same as described in Section IV.B.2.b. Consequently, there is a very likely probability of significant impacts to subsistence on the Pribilof Islands over the life of the field. Elsewhere, significant impacts to subsistence are the same as described in Section IV.B.2.b.

Effect of Additional Mitigating Measures: The potential mitigating measure of an orientation program and the proposed Information to Lessees on bird and marine mammal protection may reduce to an unknown extent the probability of short-term adverse interaction.

Cumulative Effects: Construction of a small boat harbor on St. Paul Island in 1987 could effect subsistence resources on the island through habitat modification, which could compound the potential effects to subsistence resources posed by onshore terminal construction. Otherwise, cumulative effects are the same as described in Section IV.B.2.b.

Unavoidable Adverse Effects: Unavoidable adverse effects on subsistence resources from terminal construction on the Pribilof Islands and construction in Unalaska would be the same as described in Section IV.B.2.b. The influx of OCS-induced population by this scenario may unavoidably increase accidental predation on the reindeer herd existing on St. Paul Island, although the orientation program should partially mitigate such effects. Participation of resident Aleuts in OCS-related operations could adversely effect family cohesion unavoidably as a result of changes in subsistence practices induced by such employment. Family and individual stress induced by changes in subsistence patterns could be accentuated as a function of the minority status of the resident population.

(c) Impacts on Fishing Village Livelihood: The pattern of oilspill risk to nearshore salmon fishing grounds is the same as described for the south side of the Alaska Peninsula (see Sec. IV.B.2.c.), with risk present within 30 days but absent within 3 or 10 days of a potential spill. The probability of risk to the Nelson Lagoon/Port Moller area (area A) is less than that mentioned in Section IV.B.2.c., changed from a medium to low probability to a low probability. Risk associated with the False Pass area (area B) is the same as described in Section IV.B.2.c.

Conclusion: Same as Section IV.B.2.c.

Cumulative Effects: Same as Section IV.B.2.c.

Effect of Additional Mitigating Measures: Same as Section IV.B.2.c.

Unavoidable Adverse Effects: Same as Section IV.B.2.c.

(d) Impacts on Sociocultural Systems: Potential impacts to the sociocultural systems of Unalaska are essentially the same as described for the south side of the Alaska Peninsula scenario (see Sec. IV.B.2.d.). Long-term population effects in Cold Bay, reduced by approximately 50 percent from those described for the south side of the Alaska Peninsula scenario, are not likely to bring about significant changes in the local sociocultural systems. Siting an OCS terminal and processing facility on the Pribilof Islands increases the probability of greater potential threat to the stability of sociocultural systems on the islands. The timing of the decisionmaking and negotiation processes to site facilities on St. Paul Island could aggravate and intensify the pressures on leadership figures and groups who would be in the process of establishing bottomfishing operations on the island. The potential for conflict among factions in the community could be intensified by differences in resource (renewable vs. nonrenewable) development philosophy for the long-term benefit of the island community. Fundamental changes in community values and orientations, leadership patterns, and controlling factions could be expected from the interaction described above, resulting in considerable social debris from the discontinuity and dissonance imposed on traditional sociocultural systems.

If the OCS-related facilities were annexed, there could be added incentive for new residents to seek control of formal decisionmaking institutions on the island to shape a community more to their liking. A relatively high turnover in families or the use of employment contracts could mitigate such potential effects to some extent.

Conclusion: The probability of long-term interaction of sociocultural systems with OCS-induced effects is likely in Unalaska and Cold Bay and on the Pribilof Islands. The probability of significant impacts, defined as the displacement of existing institutions of individual and social values and orientations, should interaction occur is very likely on the Pribilof Islands, and unlikely in Cold Bay and Unalaska. Consequently, there is a likely probability of significant impacts to the sociocultural systems of the Pribilof Islands, and an unlikely probability in Unalaska and Cold Bay.

Effect of Additional Mitigating Measures: Same as described for the south side of the Alaska Peninsula scenario (see Sec. IV.B.2.d.).

Cumulative Effects: Construction of the St. Paul Island small boat harbor in 1987 could increase the short-term cultural stress induced by multiple construction projects on the island. Other Federal offshore lease sales in the Bering Sea could add to the long-term sociocultural system changes on the island should the terminal and processing facilities be used to process oil and gas from these sales. The state lease sale in Bristol Bay (perhaps combined with the other Federal offshore lease sales) could increase long-term changes in the sociocultural systems of Cold Bay by encouraging additional terminal facilities in the region, such as a south peninsula terminal site.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as described for the south side of the Alaska Peninsula scenario for Cold Bay and

Unalaska. Should the resident Aleut population of St. Paul Island become a minority on the island, the long-term adverse effects on Aleut individual and social values and orientations may be unavoidable within the authority of the Department of the Interior.

(e) Impacts on Community Infrastructure:

St. Paul: The housing demand could peak at around 261 units, an increase of 6,500 percent over the units demanded with development of a bay so the south side of the Alaska Peninsula. The peak demand could put a very severe strain on the housing situation, as there are not many new units projected for construction in St. Paul. Residential land to accommodate 261 units (a mixture of 1-2 unit family housing, mobile homes, trailers, and group housing) would be approximately 15.79 hectares (39 acres). Adequate land may not be available to meet the demand.

The potential demand for educational facilities could be a total of 23 classrooms for elementary and secondary students, which is an increase of 23 percent above what was needed with development of a bay on the south side of the Alaska Peninsula.

The demand for electrical power could range from 63 to 3,938 kilowatts. This could represent an increase of 787 to 6,153 percent over the projected demand with development of a bay on the south side of the Alaska Peninsula. There could be a need for one more generator to adequately meet the above demand. Water consumption demands could range from 172,709 to 181,000,000 liters (45,625-47,906,250 gals) annually, an increase of 6,167 percent over the peak demand with development of a bay on the south side of the Alaska Peninsula. Two or three additional 757,082 liter (200,000 gal) storage tanks might alleviate a potential strain to the existing system. The sewage system demand could peak at 62,124 liters (16,411 gals) per day, an increase of 6,175 percent over the peak demand with development of a bay on the south side of the Alaska Peninsula. Solid waste demand could peak at 930,040 kilograms (941,226 lbs) per year, an increase of 6,163 percent over the peak demand with development of a bay on the south side of the Alaska Peninsula.

St. Paul's health care system may need an additional four to six physicians by 2011, which is an increase of 600 percent over the demand experienced with development of a bay on the south side of the Alaska Peninsula. An additional six acute-care beds may be needed after 2000, which is an increase of 200 percent over the demand experienced with development of a bay on the south side of the Alaska Peninsula.

St. Paul is likely to need an additional nine police officers, which is an increase of 900 percent over the demand experienced with development of a bay on the south side of the Alaska Penisula.

Communication facilities might need to meet a demand of 326 additional lines, which is an increase of 7,120 percent over the demand experienced with development of a bay on the south side of the Alaska Peninsula.

Unalaska: The housing demand could peak at 92 units, a decrease of 70 percent over the units demanded with development of a bay on the south side of the Alaska Peninsula. The potential demand for educational facilities could be one to two classrooms over the total period of 1983 to 2011. This is generally in line with the demands experienced with development of a bay on the south side of the Alaska Peninsula.

The demand for electrical power could peak at 600 kilowatts, which is a decrease of 42 percent under the demand experienced with development of a bay on the south side of the Alaska Peninsula. Water consumption demand could peak at 27,623,200 liters (7,300,000 gals) annually, which is a decrease of 42 percent less than the demand experienced with development of a bay on the south side of the Alaska Peninsula. The sewage system demand could peak at 9,466 liters (2500 gals) per day, which is a decrease of 42 percent under the demand experienced with development of a bay on the south side of the Alaska Peninsula. The solid waste disposal demand could peak at 49,706 kilograms (109,354 lbs) per year, which is a decrease of 15 percent under the demand experienced with development of a bay on the south side of the Alaska Peninsula.

Health service demands at Unalaska would be essentially the same as experienced with development of a bay on the south side of the Alaska Peninsula.

Unalaska is likely to need only four police officers, a decrease of 50 percent under the demand experienced with development of a bay on the south side of the Alaska Peninsula. Demands for fire protection would remain the same as those experienced with development of a bay on the south side of the Alaska Peninsula.

Communication facilities might peak at 50 additional lines, which is a decrease of 35 percent under the demand experienced with development of a bay on the south side of the Alaska Peninsula.

Cold Bay: The housing demand could peak at 84 units, which is a decrease of 44 percent under the demand experienced with development of a bay on the south side of the Alaska Peninsula. The potential demand for educational facilities could peak at one classroom, which is a decrease of 50 percent under the demand experienced with development of a bay on the south side of the Alaska Peninsula.

The demand for electrical power could peak at 1,132 kilowatts, which is a decrease of 31 percent under the demand experienced with development of a bay on the south side of the Alaska Peninsula. Water consumption demand could peak at 52,138,790 liters (13,778,750 gals) annually, which is a decrease of 43 percent under the demand experienced with development of a bay on the south side of the Alaska Peninsula. The sewage system demand could peak at 17,879 (4720 gals) per day, which is the same as those experienced with development of a bay on the south side of the Alaska Peninsula. The solid waste disposal demand could peak at 734 kilograms (1615 nos) per day, which is a decrease of 12 percent under the demand experienced with development of a bay on the south side of the Alaska Peninsula.

Health service demands could peak at two physicians and three acute-care beds, which is a decrease of 50 percent under the demand experienced with development of a bay on the south side of the Alaska Peninsula.

Cold Bay may experience a demand for one additional police officer, which is a decrease of 50 percent under the demand experienced with development of a bay on the south side of the Alaska Peninsula.

Communication facilities might peak at 93 additional lines which is a decrease of 87 percent under the demand experienced with development of a bay on the south side of the Alaska Peninsula.

Conclusion: St. Paul would need to provide additional facilities to meet the demands of all of its infrastructure items (housing, sewage, solid waste, etc.) with development of St. Paul as a pipeline, terminal, and tankering site.

Unalaska may be able to adequately support the changes in the demand for housing, electrical power, water, solid waste, police protection, educational, health care services, and communication facilities; however, the community would need to provide additional facilities to meet the demand for sewage and fire protection facilities.

Cold Bay may be able to adequately support the changes in the demand for educational, electrical power, solid waste, and communication facilities; however, the community may need to provide additional facilities to meet the demands for housing, water, health care service, police protection, and sewage facilities.

Effect of Additional Mitigating Measures: The mitigating measure suggested as effective for development of a terminal on the south side of the Alaska Peninsula would also be effective for development of a terminal on St. Paul Island (see Sec. IV.B.2.e.).

Cumulative Effects: The cumulative effects identified as affecting the communities with development of a bay on the south side of the Alaska Peninsula would also be apparent with development of a terminal on St. Paul (see Sec. IV.B.2.e.).

Unavoidable Adverse Effects: The unavoidable adverse effects would be the same with development of a terminal on St. Paul Island as with development of a terminal on the south side of the Alaska Peninsula (see Sec. IV.B.2.e.).

(3) Impacts on Cultural Resources: This scenario differs from the south Alaska Peninsula scenario in that it would eliminate most pipeline hazards to cultural resources such as shipwrecks in the Unimak Pass area. However, marine cultural resources would likely be impacted by marine pipelines in the area of high probability of prior human habitation near the Pribilof Islands (see Graphic 4). Development population in the Pribilofs would affect sites listed in Section III.D., and shown on Graphic 4.

Conclusion: Impacts on marine cultural resources would be more likely with a pipeline to the Pribilof Islands terminal site than with a south side of the Alaska Peninsula site. Historic sites located on the Pribilof Islands would more likely be impacted with this scenario, due to increased population. The overall probability of significant impacts to marine cultural resources and onshore sites of the Pribilof Islands is likely.

Effect of Additional Mitigating Measures: Same as Section IV.B.3.

Cumulative Effects: Same as Section IV.B.3.

Unavoidable Adverse Effects: Same as Section IV.B.3.

(4) Impacts on Economic Conditions: OCS employment impacts in the Aleutian Islands Census Division resulting from this scenario are presented in Table IV.B.4.b.-5. Employment impacts on individual communities are provided in Appendix Tables G-4 through G-6. Employment projections in the OCS and non-OCS cases are compared in Tables IV.B.4.b.-2 through -4 for the census division, and in Appendix Tables G-13 through G-15 for individual communities.

Conclusion: This scenario differs from the south side of the Alaska Peninsula scenario principally by creating much larger numbers of additional jobs at St. Paul, where only about 20 percent of the residents are currently employed. Although the forecasted expansion of bottomfish harvesting and processing may provide jobs for all of the Pribilof Islanders who desire to work, OCS development under the Pribilof Island scenario would provide an alternative source of employment in the event that the domestic bottomfish industry fails to expand as forecasted.

Effect of Additional Mitigating Measures: See Section IV.B.4.b.

Cumulative Effects: See Section IV.B.4.b.

Unavoidable Adverse Effects: See Section IV.B.4.b.

(5) Impacts on Transportation Systems:

St. Paul Island:

Impacts on Air Traffic and Airport Facilities: Given the location of a tanker loading terminal on St. Paul Island, the impacts which could be experienced for all phases of OCS development would be substantially increased from that which was discussed for the south Alaska Peninsula scenario. Table IV.B.5-1 indicates the marked increase in air traffic which would occur at the St. Paul Airport. A St. Paul based processing and loading terminal would result in a 1987 enplanement of some 48 thousand passengers, representing a monthly arrival of some 36 jet aircraft of the Boeing 737 class. This figure would dwarf the sum total of all enplanements expected for St. Paul and the non OCS baseline. During the production phase of OCS activities (post 1990), St. Paul-based enplanements should drop drastically. However, unlike the main scenario, passenger enplanements and traffic would continue throughout the life of the field. Maximum annual air traffic during the production phase should reach at least 11,000 enplanements. These impacts are such that the air facilities of St. Paul would need to undergo a substantial upgrading. The airfield would probably have to be paved as well as extended an additional 400 meters (1,300 ft). Passenger and freight holding areas would have to be established. Present navigational aids would have to be upgraded to assist traffic trying to land in the usual inclement conditions of the island. Assuming that an air support facility is established at St. Paul Island, the support helicopter traffic transiting to and from the platforms located near the island would be assumed to make 1.5 trips per day during the exploratory and developmental periods. Assuming a rough division between the servicing areas of the Cold Bay airfield and that of St. Paul, and two exploratory drill rigs serviced by the St. Paul air field, some 90 trips per month between the helicopter support base and the platforms could be assumed. During the developmental stage, some 225 trips per month could be generated to serve the five developmental platforms assumed to be in the St. Paul service area.

Impacts on Marine Traffic and Facilities: Given the location of a terminal on St. Paul Island, a subsidiary support base could be constructed by 1986 and the construction of an oil and gas processing facility begun in the next year. The support base could be an appendage to the currently invisioned small boat harbor (see Sec. IV.A.7); however, the present plans for the boat harbor would have to be upgraded to include support boat requirements. Barge and other traffic required for the developmental period on St. Paul Island would be essentially the same as that described for the south Alaska Peninsula scenario. Indeed, as the terminals would have to process the same amount of hydrocarbons and load a similar number of tankers, the berthing and acreage requirements would probably be the same. However, unlike the south Alaska Peninsula scenario which proposes a facility located in an ice-free environment, the St. Paul Island region is periodically affected by winter ice which could restrict the movement of non-icebreaking tankers. Given the occurrence of ice in the area, transport may be accomplished by the employment of ice-breaking tankers of the 135,000 cubic meters and 100,000 deadweight tons class. During peak production, the St. Paul facility could load such tankers at a rate of one oil tanker per day and one LNG tanker every 5 days. However, within 10 years the production curve as indicated in Table II.D.l.a-1 would dictate that only one oil tanker would be loaded every 8 days while an LNG tanker would be loaded every 6 or 7 days. These vessels would presumably proceed through Unimak Pass to market.

St. George Island: No impacts are perceived for St. George Island unless engineering and other constraints require that a terminal be sighted there. Should St. George be utilized as a terminal site, impacts would be similar to those which were described for St. Paul Island. However, since St. George has no viable airfield, it is probable that the existing dirt runway on the island would need to be upgraded to accomodate the OCS-related aircraft.

Dutch Harbor/Unalaska:

Impacts on Air Traffic Facilities: Table IV.B.5-1 indicates that air traffic entering the Unalaska/Dutch Harbor airport as a result of a St. Paul terminal site would be substantially reduced from that which was forecast for the south Alaska Peninsula scenario. Transportation enplanements during the peak of OCS activities (1988) may only be slightly more than one third of that which was forecast for the main scenario. Given that Unalaska will shortly upgrade its airfield by adding a jet aircraft runway and more sophisticated navigational aids, the capacity and operating ability of the airport will be increased to such a degree that the proposed action, under this scenario, should not result in significant impacts to this airfield.

Impacts on Marine Traffic and Commerce: As Unalaska/Dutch Harbor would function as the primary marine support facility for all boat transportation scenarios, impacts on the marine facilities of this area would not be different from those which described for the main scenario.

Unimak Pass: The principal difference in vessel traffic movement between the alternate scenarios and the main scenario is that tanker traffic is perceived under the alternate scenarios to pass through the Unimak Pass, while tanker traffic of the main scenario would proceed directly from a bay located on the south side of the Alaska Peninsula. The impact of this traffic on the Unimak Pass is difficult to estimate as the current level of traffic in the Unimak Pass has yet to be calculated satisfactorily. However, in light of that uncertainty, a figure of 2,000 vessel trips per year was calculated for the present (see Sec. III.7.). Using 100,000 deadweight tons and 135,000 cubic meters class oil and LNG carriers as a standard, in 1994, oil and gas vessel traffic transiting the Unimak Pass as a result of the proposal can be estimated at some 444 tankers. By the year 2000, tanker traffic through the pass could reach 160 trips per year. Given the area's rapid bottomfish industry development, it is very possible that by the year 2000 OCS tankerage would be only a very minor portion of total marine traffic passing through the Unimak Pass.

Cold Bay:

Impacts on Air Traffic and Facilities: Air traffic arriving at the Cold Bay airfield as a result of the Pribilof siting option would be reduced by some 20 percent compared to the main scenario. Even so, peak enplanement would be two and one-half times the base case projection. Such an increase in personnel would require the construction of additional temporary housing and dining accommodations. The short-term impacts of this transportation option on the Cold Bay airfield and its facilities would be similar to that hypothesized for the south Alaska Peninsula scenario.

Conclusion: It is very likely that the transportation systems of St. Paul, Unalaska/Dutch Harbor and Cold Bay would be impacted by the proposed action using this transportation scenario. It is very likely that the impact would be significant. The overall probability of significant impact on the transportation systems of the area could be considered to be very likely. Air traffic increases would cause short-term strain on the Cold Bay airfield and extreme impact on the St. Paul airfield. Both airfields would have to undergo some renovations and a refitting. The St. Paul airfield would need extensive improvements. Impacts on marine transportation systems under this transportation scenario would be similar to those described for the south Alaska Peninsula scenario.

Effect of Additional Mitigating Measures: See Section IV.B.5.

Cumulative Effects: See Section IV.B.5.

Unavoidable Adverse Impacts: See Section IV.B.5

(6) Impacts on Coastal Zone Management: The proposal, with development of a pipeline to a terminal on St. Paul Island and tankering out of St. Paul, is not expected to adversely affect a potential district Coastal Management Program (CMP) for the Pribilof Islands area. The Pribilof Islands CMP could experience less impacts than identified if a terminal were developed on the south side of the Alaska Peninsula (see Sec. IV.B.6.).

Conclusion: Development of a terminal on St. Paul would not create impacts to the CMP different from those if the south side of the Alaska Peninsula were developed.

Effect of Additional Mitigating Measures: The mitigating measures proposed as effective for development of a terminal on the south side of the Alaska Peninsula would also be effective for development of a terminal on St. Paul Island.

Cumulative Effects: Cumulative effects upon the district CMP in the Pribilof Islands would be the same as those experienced if a terminal were developed on the south side of the Alaska Peninsula.

Unavoidable Adverse Effects: The development of St. Paul as a terminal and tankering site would create the same unavoidable adverse effects as those experienced with development of a terminal on the south side of the Alaska Peninsula.

b. Makushin Bay Scenario: The following impact analyses are based on a scenario which entails transportation of oil by pipeline to a terminal located at the edge of Makushin Bay. From there, oil would be transported via Unimak Pass to unspecified location in the contiguous U.S.

Refer to Section II of this EIS for a more detailed description of this scenario.

(1) Impacts on Biological Resources:

(a) Impacts on Fisheries: Makushin Bay is a most productive fishery area for both shellfish and finfish. In 1980 this bay yielded a commercial catch of over 2 million pink salmon and 500,000 pounds of shrimp. A 1,000 barrel spill from a tanker or pipeline has a 26-percent chance of contacting at least the outer portions of Makushin Bay within 10 days of its occurrence and could adversely impact salmon and shellfish.

While oilspills would be of major concern, fisheries impacts could also result from land disturbance adjacent to the terminal sites, e.g., dredging for construction of a deepwater moorage-loading facility. Dredging would cause siltation which could increase interference with migration and spawning.

Conclusion: An oil pipeline to Makushin Bay and tankering from there could impact the finfish and shellfish of Makushin Bay. The probability of interaction is likely. If an interaction were to occur the impacts would be significant. The overall probability of significant impact is likely.

Effect of Additional Mitigating Measures: See Section IV.B.1.a.

Cumulative Effects: Those already discussed for the proposal also apply to this oil transportation mode as well.

Unavoidable Adverse Effects: See Section IV.B.la.

Impacts on Commercial Fishing: Makushin Bay, an area where significant numbers of salmon and shrimp are now harvested would likely see a reduction in these commercial catches were this scenario adopted. This scenario would result in an increased likelihood of space conflicts between oil industry vessels and fishing vessels, fish tenders, and floating fish processors compared to a south Alaska Peninsula scenario. Gear loss, and gear and catch damage from entanglement and oilspills respectively would impact the fishing industry. However, compensatory funds have been established to mitigate adverse effects on commercial fishermen due to OCS-related activities (see Casey, 1981).

Conclusion: Use of Makushin Bay for transhipment of petroleum would result in a moderate impact on the commercial fishery operating there during relatively short fishing periods annually. Interaction between commercial fishing and oil development is likely. If interaction occurs, impacts on the commercial fishery in Makushin Bay would be significant. Overall, the probability of significant impact is likely.

Effect of Additional Mitigating Measures: The orientation program would incorporate shrimp fishing methodology to alleviate potential for conflict with the trawlers during the several days this bay is open for shrimp harvest. A traffic separation scheme in Makushin Bay could help minimize vessel conflict and loss of or damage to fishing gear.

Cumulative Effects: Improved communication and transportation ancillary to oil development here would lead to use of the Makushin Bay area by other industry, probably fisheries related, e.g., processing plants which could further congest vessel traffic within the bay and increase the likelihood of vessel conflicts.

Unavoidable Adverse Effects: Those previously identified in the proposal would remain; oilspill impacts on commercial fishing would become more severe.

(b) Impacts on Marine and Coastal Birds:

Site-Specific Impacts: Tanker loading in Makushin Bay and departure via Unimak Pass would place at risk several large seabird colony areas in the eastern Aleutians including (Table III.B.2.-2): Bogoslof and Fire Islands (population 93,000), Baby Islands (181,000), Egg Island (627,000) and the Krenitzin Islands (500,000).

Oilspill contact probabilities in these areas are significantly higher than for the south Alaska Peninsula scenario, ranging from 44 percent (Impact Zone 9: Unimak Pass) and 69 percent (Impact Zone 5: Krenitzin, Baby, and Egg Islands) to 65 percent (Impact Zone 4: Bogoslof Island). Significant impact on breeding populations could occur if a 1,000-barrel oilspill were to contact, for example, one of the huge foraging concentrations of tufted puffins which have been sighted in the Krenitzen Islands. Foraging assemblages in the vicinity of the colonies on Bogoslof NWR also would be highly vulnerable, as would such species as the endemic whiskered auklet that congreates in large numbers in tide rips of the eastern passes. Probabilities of contacting waterfowl concentrations which overwinter in the Krenitzen Islands, Makushin Bay, northwest shore of the Unalaska Island, southeast shore of Unimak Island, and Samalga Island, are lower than for those areas near the pass though still substantial, ranging from 18 to 26 percent (Impact Zone 2 and Boundary Segments 1-3). Probability of oilspills contacting the area offshore from Izembek Lagoon (Impact Zone 11) is 24 percent with this transportation scenario, compared to 41 percent for the south Alaska Peninsula scenario. Chronic oil pollution in these areas could have serious long-term effects such as precipitating avoidance or abandonment of traditional winter foraging grounds for areas where there is less or lower quality food, or more competition, resulting in decreased overwinter survival. Potential impact of this transportation scenario on seabirds utilizing Unimak Pass and the area surrounding its western entrance would be the same as described for the Pribilof-Unimak Pass route.

Conclusion: Critical areas most likely to be affected by transport of oil from Makushin Bay are the eastern Aleutian Islands and Unimak Pass.

Probability of seabird-oilspill interaction in the eastern Aleutian area appears likely, and since the most numerous species are highly sensitive to oilspills and tend to forage in large flocks, a significant impact on the population is considered likely should an interaction occur. Thus, the probability of a significant impact in this area is likely. Waterfowl overwintering in the eastern Aleutians would not likely experience a significant oilspill impact except possibly in the Krenitzin Islands.

Although interactions in Unimak Pass would likely be regionally significant, chance of interactions occurring is considered unlikely, and thus probability of significant impact also is considered unlikely.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as described for the south Alaska Peninsula scenario (see Sec. IV.B.1.b.).

Cumulative Effects: Cumulative effects would be the same as described for the south Alaska Peninsula scenario (see Sec. IV.B.1.b.).

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as those described for the south Alaska Peninsula scenario (see Sec. IV.B.1.b.).

(c) Impacts on Marine Mammals:

Site-Specific Impacts: Tanker loading at Makushin Bay and departure via Unimak Pass could result in impacts to the numerous sea lion rookeries and hauling areas in the eastern Aleutian Islands, as well as fur seals during migration and sea otters and harbor seals year round. Over 16,000 sea lions are estimated to breed in this area.

Oilspill contact probabilities along this route are significantly higher than for the south Alaska Peninsula scenario ranging from 44 versus 7 percent (Impact Zone 9: Unimak Pass - Krenitzin Islands) and 69 versus 0 percent (Impact Zone 5: Akutan Pass Unalaska Island) to 65 versus 0 percent in the vicinity of Bogoslof National Wildlife Refuge (Impact Zone 4). Sensitivity of sea lions to oilspills is not documented, but repeated contact by females during the breeding period could be expected to impact this population, possibly in decreased pup survival or abandonment of traditional rookeries if chronic exposure occurred. Impacts on sea otters and harbor seals would be essentially like those discussed above for the south Alaska Peninsula transportation scenario. Oilspills in the vicinity of Unimak Pass especially during spring and fall migration would place at risk a large proportion of the fur seal breeding stock traversing this area. Currents in the pass would tend to move spills westward and thus place at greater risk the area surrounding the western pass entrance than the pass itself.

Conclusion: Critical areas most likely to be affected by transport of oil from Makushin Bay are the eastern Aleutians and Unimak Pass.

Probability of oilspill contact in eastern Aleutian areas is moderate. Sea lions and harbor seals are unlikely to suffer significant effects unless spills become chronic; however, more sensitive sea otters and fur seals are likely to be impacted. Overall probability of significant oilspill-marine mammal interaction is considered unlikely.

Interaction between oilspills and fur seals in Unimak Pass are considered unlikely; however, spills occurring in this area during the period when pregnant and other breeding females are passing through are likely to have a significant effect on the population. Probability of significant interaction is more likely in the area west of the pass entrance than in the pass itself.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the proposal (see Sec. IV.B.1.c.).

Cumulative Effects: Cumulative effects would be the same as those described for the south Alaska Peninsula scenario (see Sec. IV.B.1.c.).

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as those described in Section IV.B.1.c.

(d) Impacts on Endangered Species: Of all the transportation modes, this mode would increase risk to the Unimak Pass region and adjacent shorelines as much or more than any other (as compared to a pipeline to the Alaska Peninsula). For example, risks to inner Unimak Pass (Appendix E, Table 22, Hypothetical Targets 9-10) would be at 22 to 44 percent as compared to risks incured with a proposed pipeline to the Alaska Peninsula (Appendix E, Table 20, 0-16%). Oilspill risks to outer Unimak Pass are also higher (Appendix E, Table 22, 26-69%) but approximate those which would be incurred by offshore loading (see Sec. IV.B.7.c.).

Conclusion: Probability of interaction of oilspills with endangered species in the Unimak Pass region would be much higher if oil were piped to an Aleutian Island west of Unimak Pass than if it were piped towards the Alaska Peninsula. Also, since the nearshore areas of Akutan, Akun, and Unalaska Islands are possibly areas of relatively high concentration of endangered whales (not to mention possibly greatest diversity) the probability of such interaction leading to a significant effect on a whale population would also be higher than as discussed in Section IV.B.1.d. As discussed in Section IV.B.7.a., this transportation mode may increase the probability of localized disturbance effects on cetaceans.

Effect of Additional Mitigating Measures: See Section IV.B.1.d.

Cumulative Effects: See Section IV.B.1.d.

Unavoidable Adverse Effects: See Section IV.B.1.d.

(2) Impacts on Social Systems:

(a) Impacts on Population: Although reduced numerically, OCS-related population in Cold Bay would still comprise 21 to 31 percent of total population over the life of the field. OCS-related population in Unalaska would be approximately three times that described for the south Alaska Peninsula scenario over the long-term life of the project. Despite this numerical increase, population generated by OCS activities in Unalaska would constitute 17 percent of total population (623 of 3,568) in 1985, compared with 15 percent under the primary scenario, and 11 percent or less of total population through the year 2000. Population effects on the Pribilof Islands would be comparable with south side of the Alaska Peninsula scenario.

Conclusion: The probability of significant population impact should interaction occur, defined as an added 30 percent component of total population at any point in time, is reduced in the long-term in Cold Bay by approximately one-third. Such effects in Unalaska should be comparable to the south Alaska Peninsula scenario as a proportion of total population. Consequently, the probability of significant population impacts from the proposal is likely in Cold Bay and unlikely in Unalaska and on the Pribilof Islands.

Effect of Additional Mitigating Measures: Same as with the south side of the Alaska Peninsula scenario (see Sec. IV.B.2.a.).

Cumulative Effects: Construction projects in Unalaska could increase the short-term population impacts associated with construction of the terminal facility on the island as well as providing offshore support operations. Otherwise, cumulative effects are the same as with the south side of the Alaska Peninsula scenario (see Sec. IV.B.2.a.).

Unavoidable Adverse Effects: Same as with the south side of the Alaska Peninsula scenario (see Sec. IV.B.2.a.).

(b) Impacts on Subsistence Patterns: Population effects on subsistence resources should be the same as described for the south side of the Alaska Peninsula scenario (Sec. IV.B.2.b.) in Cold Bay, Unalaska, and the Pribilof Islands. Risks from oil pollution events are the same as the primary scenario for the Pribilof Islands and essentially the same east of Unimak Pass. Potential risks from oilspills of the villages located west of Unimak Pass are increased with this scenario. As shown in Figure III.C.2.-2, risk to the inner reaches of Akutan Bay could most directly affect the subsistence catch, especially for intertidal organisms used year round and during salmon fishing season should a spill occur at that time. A terminal sited on Makushin Bay could affect seal and migratory waterfowl hunting by Unalaska residents during construction, as well as within Unalaska Bay. After construction, it is unlikely such resources would be displaced by the effects of terminal operations.

The probability of substituting subsistence resources in each of these communities would depend on a variety of biological, seasonal and technical factors. Potentially greater technical capability exists in Unalaska and

Akutan for resource substitution than in Nikolski, not only in terms of greater potential for increasing subsistence ranges but also in procuring resources from the vessels regularly calling at these processing centers.

Conclusion: The potential for interaction of subsistence resources with the effects of oilspill incidents on the Pribilof Islands and east of Unimak Pass is essentially the same as described in Section IV.B.2.b. West of Unimak Pass, the potential for interaction changes from nil in the primary scenario to very likely in Akutan, likely in Unalaska and unlikely in Nikolski (due to distance). The probability of significant impacts (primary subsistence resources unavailable for a limited duration) should interaction occur is the same as described in Section IV.B.2.b. on the Pribilof Islands and east of Unimak Pass, whereas significant impacts given interaction west of Unimak Pass are likely in Nikolski and unlikely in Unalaska and Akutan. Consequently, there is an unlikely probability of significant impacts over the life of the field to subsistence west of Unimak Pass. With this finding, significant impacts to subsistence are the same as described in Section IV.B.2.b.

Effect of Additional Mitigating Measures: The potential mitigating measure of an orientation program and the Information to Lessees on bird and marine mammal protection may reduce to an unknown extent the probability of short-term adverse interaction.

Cumulative Effects: Other Federal offshore lease sales in the Bering Sea could increase the risk to subsistence resources west of Unimak Pass through increased tankering activity from the Makushin Bay terminal and through Unimak Pass. Otherwise, cumulative effects are the same as described in Section IV.B.2.b.

Unavoidable Adverse Effects: Unavoidable adverse effects on subsistence resources from terminal construction on Makushin Bay and construction on Unalaska would be the same as described in Section IV.B.2.b.

(c) Impacts on Fishing Village Livelihood: The pattern of oilspill risk to nearshore salmon fishing grounds is the same as described in Section IV.B.2.c., with risk present within 30 days but absent within 3 or 10 days of a potential spill. The probability of risk to the Nelson Lagoon/Port Moller area (area A) is less than that described for the south Alaska Peninsula scenario (Sec. IV.B.2.c.) changed from a medium to low probability to a low probability. Risk associated with the False Pass area (area B) is the same as in Section IV.B.2.c.

Conclusion: Same as Section IV.B.2.c.

Effect of Additional Mitigating Measures: Same as Section IV.B.2.c.

Cumulative Effects: Same as Section IV.B.2.c.

Unavoidable Adverse Effects: Same as Section IV.B.2.c.

(d) Impacts on Sociocultural Systems: The potential impacts on the sociocultural systems are essentially the same as described for the south side of the Alaska Peninsula scenario (see Sec. IV.B.2.d.). Population effects in Cold Bay are reduced by approximately 50 percent, thus reducing the likelihood of interaction from OCS development and the potential for long-term change in local sociocultural systems.

Conclusion: The probability of long-term interaction of sociocultural systems with OCS-induced effects is likely in Unalaska and Cold Bay and unlikely on the Pribilof Islands. The probability of significant impacts, defined as the displacement of existing institutions of individual and social values and orientations should interaction occur is unlikely in Unalaska and Cold Bay and on the Pribilof Islands. Consequently, there is an unlikely probability of significant impacts to the sociocultural systems of Unalaska, Cold Bay and the Pribilof Islands.

Effect of Additional Mitigating Measures: Same as Section IV.B.2.d.

Cumulative Effects: The small boat harbor construction project on St. Paul Island would add little additional affect to changes in sociocultural systems brought about in the long-term by the growth of the bottomfishing industry. In Unalaska, construction projects could increase the short-term stress induced by multiple construction projects, but the cultural consequences should be insignificant compared to the long-term prospects for sociocultural system change induced by the development of bottomfishing. Other Federal offshore lease sales in the Bering Sea and the state lease sale in Bristol Bay could intensify sociocultural system changes anticipated in Cold Bay by encouraging additional terminal facilities in the region, such as a south peninsula terminal site.

Unavoidable Adverse Effects: Same as Section IV.B.2.d.

(e) Impacts on Community Infrastructure:

St. Paul: The housing demand, with development at Makushin Bay as a pipeline, terminal, and tankering operation, would be very slight, one to five dwelling units, which is the same demand experienced with development of a bay on the south side of the Alaska Peninsula.

There is not likely to be a demand for educational facilities with development of a terminal at Makushin Bay, which is the same demand experienced with development of a bay on the south side of the Alaska Peninsula.

The demand for electrical power could peak at 8 kilowatts, which is a decrease of 12 percent under the demand experienced with development of a terminal on the south side of the Alaska Peninsula. Water consumption demands could peak at 345,290 liters (91,250 gals) annually, which is a decrease of 12 percent under the demand experienced with development of a terminal on the south side of the Alaska Peninsula. The sewage system demand could peak at 118 liters (31 gals) per day, which is a decrease of 12 percent under the demand experienced with development of a terminal on the south side of the Alaska Peninsula. The solid waste disposal demand could peak at 1,775 kilograms (3,906 lbs) per year, which is a decrease of 12 percent under the demand experienced with development of a terminal on the south side of the Alaska Peninsula.

St. Paul may demand one additional physician by 2019 for adequate health care, which is the same as experienced with development of a terminal on the south side of the Alaska Peninsula.

Police and fire protection demands could be the same as experienced with development of a terminal on the south side of the Alaska Peninsula. The demand for communication facilities would be the same as experienced with development of a terminal on the south side of the Alaska Peninsula.

Unalaska: The housing demand could peak at 286 units, which is an increase of 218 percent over the demand experienced with development of a terminal on the south side of the Alaska Peninsula.

The demand for educational facilities could peak at an average of four classrooms every two to three years for elementary and secondary students, which is an increase of 200 percent over the demand experienced with development of a bay on the south side of the Alaska Peninsula.

The demand for electrical power could peak at 3,828 kilowatts, which is an increase of 268 percent over the demand experienced with development of a bay on the south side of the Alaska Peninsula. Water consumption demands could peak at 176,000,000 liters (46,583,125 gals) annually, which is an increase of 268 percent over the demand experienced with development of a bay on the south side of the Alaska Peninsula. The sewage system demand could peak at 60,408 liters (15,958 gals) per day, which is an increase of 268 percent over the demand experienced with development of a bay on the south side of the Alaska Peninsula. The solid waste demand could peak at 906,254 kilograms (1,993,757 lbs) annually, which is an increase of 268 percent over the demand experienced with development of a bay on the south side of the Alaska Peninsula.

The demand for health services could peak at one physician every two years until 1992 and four more by 2019, which is an increase of 400 percent over the demand experienced with development of a bay on the south side of the Alaska Peninsula.

The demand for police officers could peak at a total of 25 by 2019, which is an increase of 312 percent over the demand experienced with development of a bay on the south side of the Alaska Peninsula. The demand for fire protection would remain about the same as experienced with development of a bay on the south side of the Alaska Peninsula. The demand for communication facilities could peak at an additional 317 lines, which is an increase of 221 percent over the demand experienced with development of a bay on the south side of the Alaska Peninsula.

Cold Bay: The housing demand could peak at 86 units, which is a decrease of 45 perecnt under the demand experienced with development of a bay on the south side of the Alaska Peninsula.

The demand for educational facilities could peak at one additional classroom, which is a decrease of 50 percent under the demand experienced with development of a terminal on the south side of the Alaska Peninsula.

The demand for electrical power could peak at 1,305 kilowatts, which is a decrease of 36 percent under the demand experienced with development of a terminal on the south side of the Alaska Peninsula. Water consumption demands could peak at 60,080,460 liters (15,877,500 gals) annually, which is a decrease of 49 percent under the demand experienced with development of a terminal on the south side of the Alaska Peninsula. The sewage system demand could peak at 20,602 liters (5,439 gals) per day, which is an increase of 115 percent over the demand experienced with development of a bay on the south side of the Alaska Peninsula. The solid waste disposal demand could peak at 846 kilograms (1,862 lbs) per day, which is a decrease of 738 percent under the demand experienced with development of a terminal on the south side of the Alaska Peninsula.

The demand for health care services may peak at two physicians, which is the same as experienced with development of a terminal on the south side of the Alaska Peninsula.

The demands for police and fire protection and communication facilities could be the same as with development of a bay on the south side of the Alaska Peninsula.

Conclusion: St. Paul may be able to adequately support the changes in the demand for electrical power, housing, education, water, sewage, helath care services and police protection; however, the community would need to provide additional facilities to meet the demands for solid waste disposal, fire protection, and communication facilities.

Unalaska may be able to adequately support the changes in the demand for fire protection; however, the community would need to provide additional facilities to meet the demands for housing, educational, electrical power, water, sewage, solid waste disposal, health care services, police protection, and communication facilities.

Cold Bay may be able to adequately support the changes in the demand for educational, electrical power, solid waste disposal, fire protection, and communication facilities; however, the community would need to provide additional facilities to meet the demands for housing, water, sewage, health care services, and police protection.

Effect of Additional Mitigating Measures: The mitigating measures proposed as effective for development of a terminal on the south side of the Alaska Peninsula would also be effective for development of Makushin Bay (see Sec. IV.B.2.e.).

Cumulative Effects: The cumulative effects identified as affecting the communities with development of a terminal on the south side of the Alaska Peninsula would also be apparent with development at Makushin Bay (see Sec. IV.B.2.e.).

Unavoidable Adverse Effects: The unavoidable adverse effects would be the same with development at Makushin Bay as with development of a terminal on the south side of the Alaska Peninsula (see Sec. IV.B.2.e.).

(3) Impacts on Cultural Resources: The Makushin Bay terminal scenario would eliminate hazards to marine cultural resources near the Pribilof Islands (see Graphic 4) cultural resources such as shipwrecks in

the Unimak Pass (see Table III.D.-1), and onshore resources in the Pribilof Islands and the Cold Bay area. However, since Unimak Pass would likely be used for oil tankers with this scenario, there would be hazards to cultural resources in the Unimak Pass area. Impacts on cultural resources would (see Graphic 4) be likely near Nikolski, Makushin Bay, and Dutch Harbor/Unalaska.

Conclusion: The impacts to cultural resources would be less likely with the Makushin Bay terminal scenario than with the south Alaska Peninsula scenario.

Effect of Additional Mitigating Measures: Same as Section IV.B.3.

Cumulative Effects: Cumulative effects would be reduced from those described in Section IV.B.3.

Unavoidable Adverse Effects: Same as Section IV.B.3.

(4) Impacts on Economic Conditions: OCS employment impacts in the Aleutian Islands Census Division resulting from this scenario are presented in Table IV.B.4.b.-6. Employment impacts on individual communities are provided in Appendix Tables G-7 through G-9. Employment projections in the OCS and non-OCS cases are compared in Tables IV.B.4.b.-2 through -4 for the census division, and in Appendix Tables G-13 through G-15 for individual communities.

This scenario differs very little from the south side of the Alaska Peninsula scenario, in terms of types of employment effects on the entire census division. However, this scenario does result in a much bigger employment impact on the community of Unalaska and a much smaller employment impact on Cold Bay. This difference does not alter the major conclusions regarding the economic impacts of OCS development.

Conclusion: See Section IV.B.4.b.

Effect of Additional Mitigating Measures: See Section IV.B.4.b.

Cumulative Effects: See Section IV.B.4.b.

Unavoidable Adverse Effects: See Section IV.B.4.b.

(5) Impacts on Transportation Systems:

St. Paul Island:

Impacts on Air Traffic and Airport Facilities: The location of a tanker loading terminal at Makushin Bay would have the impact of raising the expected exploratory period passenger traffic on St. Paul Island to some 60 percent greater than expected for the base line conditions. During the production phase OCS activities would result in only a 5 percent increase over baseline conditions. Under the Makushin Bay scenario, air traffic would continue into the production phase although at reduced levels; whereas under the main scenario, air transportation would curtail after the exploratory period. As a result of this air traffic, the St. Paul airfield would have to undergo renovation, expansion, and paving. Navigational aids would require upgrading. Sleeping accommodations, warehouses, and paved areas for aircraft maintenance machinery storage would have to be constructed.

Impacts to Marine Facilities: Under this transportation scenario, no impacts on the marine systems on St. Paul Island would occur, as the majority, if not all, of the marine support under this transportation scenario would take place in the Unalaska/Dutch Harbor area.

Makushin Bay: Makushin Bay is virtually unpopulated and entirely lacking any type of infrastructure. The bay would be used primarily as a hydrocarbon terminal site and only secondarily as a support base. A support base would be hypothesized for this location only as the result of a spill over effect for Dutch Harbor (see discussion under primary transportation scenario). The terminal facility located at Makushin Bay would be similar to that described for St. Paul. As Makushin Bay is a deep water area, it is likely that it would be able to service very large crude carriers (VLCC's). The use of VLCC's loaded out of Makushin would result in annual tanker traffic numbers equal to that of the proposed action and approximately 40 percent of that with the St. Paul scenario. It is supposed that tankers issuing from Makushin Bay would follow the great circle route and exit through the Unimak Pass.

Cold Bay:

Impacts on Air Traffic and Facilities: The impacts hypothesized for the Cold Bay airfield under a Makushin Bay terminal transportation scenario would be equal to those described for the south Alaska Peninsula scenario. For a further discussion of impacts on air facilities at the Cold Bay airfield (see Sec. IV.B.5).

Conclusion: The probability that this alternative with the Makushin Bay scenario would interact with the transportation systems is very likely and the probability of significant impact, given this interaction, is very likely. The overall probability of significant impact would be very likely.

Effect of Additional Mitigating Measures: See Section IV.B.5.

Cumulative Effects: See Section IV.B.5.

Unavoidable Adverse Impacts: See Section IV.B.5.

(6) Impacts on Coastal Zone Management: The proposal, with development of a pipeline to a terminal at Makushin Bay and tankering out of the bay, is not expected to adversely affect a potential district Coastal Management Program (CMP) for the Aleutian Islands southwest of Unimak Pass. The Aleutian Island CMP could experience the same impacts as identified if a terminal were developed on the south side of the Alaska Peninsula (see Sec. IV.B.6.).

Conclusion: Development of a terminal at Makushin Bay would not create impacts to the CMP different from those if a terminal on the south side of the Alaska Peninsula were developed.

Effect of Additional Mitigating Measures: The mitigating measures proposed as effective for development of a bay on the south side of the Alaska Peninsula would also be effective for development of a terminal at Makushin Bay.

Cumulative Effects: Cumulative effects upon the district CMP in the Aleutian Islands southwest of Unimak Pass would be the same as those experienced if a terminal on the south side of the Alaska Peninsula were developed.

Unavoidable Adverse Effects: The development of Makushin Bay as a terminal and tankering site would create the same unavoidable adverse effects as those experienced with development of a terminal on the south side of the Alaska Peninsula.

c. Offshore Scenario: The following impact analyses are based on a scenario which entails processing and loading of oil and gas offshore. Refer to Section II for a more detailed discussion of this scenario.

(1) Impacts on Biological Resources:

(a) Impacts on Fisheries: The offshore scenario would have a low adverse impact on fisheries resources. The probability of interaction between fisheries and oil and gas activities is unlikely. Were interaction to occur, the impact would be insignificant. The overall probability of significant impact is unlikely.

Conclusion: See above.

Effect of Additional Mitigating Measures: No changes from the discussion for the proposal (see Sec. IV.B.1.a.).

Cumulative Effects: No change from discussion for the proposal (see Sec. IV.B.1.a.).

Unavoidable Adverse Effects: Same as proposal (see Sec. IV.B.1.a.).

(b) Impacts on Marine and Coastal Birds:

Site-Specific Impacts: Spills occurring as a result of offshore tanker loading primarily would affect birds foraging in the central region in and near the proposed sale area, at the shelfbreak, west of Amak Island, and Unimak Pass. Probability of oilspills contacting pelagic targets (Impact Zones 14-17) where bird densities can exceed 600 birds per square kilometer ranges from 35 to 65 percent, slightly greater than with the south Alaska Peninsula transportation scenario. Constant movement of flocks through this huge area precludes accurate prediction of seabird-oilspill interaction.

Contact probability along the shelfbreak (Impact Zones 19-20), which provides important foraging habitat especially for red-legged kittiwakes (88% of the world population nests on the Pribilof Islands), ranges from 25 to 42 percent, well above the risk to this area by the south Alaska Peninsula route (4-23%). Likewise, contact probabilities in and around Unimak Pass, where an estimated 720,000 birds may be found at any given time in summer, and shearwater flocks in excess of 100,000 are not uncommon, are much higher with offshore tankering

(36% at the entrance to the pass, 93% beyond the west entrance) than from a south side Alaska Peninsula scenario (0%,72%). Nearer the pass (Boundary Segment 4), contact probability is only 5 percent.

Because of the distance between potential spill sources and major bird concentrations, as well as the variability in bird densities, it appears unlikely that major flocks would come into contact with oilspills originating in the proposed sale area. However, tankers moving through Unimak Pass still could pose a major threat to bird populations utilizing this and adjoining areas; this appears to be the greatest risk with the offshore tankering route.

Conclusion: Except in the vicinity of Unimak Pass, offshore seabird-oilspill interactions would be unlikely. In the area northwest of the pass, high contact probability indicates that interactions are likely; however in the pass, lower probabilities suggest interactions are unlikely.

Should interactions occur, the high oil sensitivity of principal species occupying the area suggests that they would result in significant regional impacts. Overall probability of significant impact is considered unlikely.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as described for the south Alaska Peninsula scenario (see Sec. IV.B.1.b.).

Cumulative Effects: Cumulative effects would be the same as described for the south Alaska Peninsula scenario (see Sec. IV.B.1.b.).

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as described for the south Alaska Peninsula scenario (see Sec. IV.B.1.b.).

(c) Impacts on Marine Mammals:

Site-Specific Impacts: Oilspills occuring as a result of tanker loading at an offshore site primarily would affect marine mammals utilizing the pelagic area between the Pribilof Islands and Unimak Pass (mainly fur seals), along the shelfbreak (fur seals), west of Amak Island (sea otter, sea lion, harbor seal) and the area surrounding Unimak Pass west entrance (all four species).

Spills originating at an offshore loading site would have the greatest probability of impacts on northern fur seals during the period May to December when they are utilizing a broad corridor between Unimak Pass and the Pribilof Islands, including most of the proposed sale area. At least 425,000 seals are in the water at any given moment, a majority of them nursing females representing a large proportion of the breeding stock of their population. Wide separation of potential spill points and variable density and movements of seals precludes accurate prediction of interaction with oilspills, but an indication of risk to this pelagic population is provided by probability of contact with randomly placed impact zones (14-17) in this large central area. These range from 35 to 65 percent, somewhat greater than the south Alaska Peninsula scenario (29-60%) and indicate mainly a moderate likelihood of interaction. Simulated trajectories move across this area only in winter after the bulk of the fur seal population has departed.

Contact probability along the shelfbreak (Impact Zones 19-20), which provides important foraging habitat for fur seals, ranges from 25 to 42 percent, well above the risk to this area by the south Alaska Peninsula scenario (4-23%). West of Amak Island (Impact Zone 11), probability of contact is 36 percent, only a slight improvement over the south Alaska Peninsula scenario where the risk to this area is 41 percent. Likewise, contact probabilities near the important migration corridor of Unimak Pass (Impact Zones 9-10, 5-8) are much higher with offshore tankering (36% at the entrance to the pass, 93% beyond the west entrance) than from a south side Alaska Peninsula scenario (0%, 72%). In the pass (Boundary Segment 4), contact probability is only 5 percent. It appears that the greatest risk to marine mammal populations from offshore loading would be from tankers moving through Unimak Pass.

Conclusion: Except in the vicinity of Unimak Pass west entrance, pelagic marine mammal-oilspill interactions would be unlikely. Interaction between fur seals and oilspills in Unimak Pass is also considered unlikely; however, interactions are considered likely in the area surrounding the west entrance of the pass. In either case, sensitivity of fur seals to oil contact suggest that spills occurring in this area during the period when pregnant and other breeding females are passing through would likely have a significant effect on the population. Overall probability of significant impact is more likely in the area west of the pass entrance than in the pass itself.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the south Alaska Peninsula scenario (see Sec. IV.B.1.c.).

Cumulative Effects: Cumulative effects would be the same as those described for the south Alaska Peninsula scenario (see Sec. IV.B.1.c.).

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as those described for the south Alaska Peninsula scenario (see Sec. IV.B.1.c.).

(d) Impacts on Endangered Species: Examination of Appendix E, Table 31 shows that the probability of spills associated with offshore loading intersecting the Unimak Pass region (Hypothetical Targets 5-10) are higher (from 21-70% chance) than would be incurred by pipeline towards the Alaska Peninsula (from 7-41%). Also spill incursion into areas near the Pribilofs would be somewhat greater. Offshore areas represented by Hypothetical Target 14-17, Appendix E, Table 31, would be at 35 to 65 percent chance of spill hits, about 5 to 6 percent greater than would be incurred under a pipeline to the Alaska Peninsula region. Thus, probabilities of interaction of oilspills and endangered whales (or their habitats) would be higher throughout the proposed sale area, especially in the Unimak Pass region as compared to the probabilities which would be associated with pipeline transport to the east. In light of the seasonal importance of the Unimak Pass region and nearshore habitats of eastern Aleutian Islands to certain species of endangered whales, probability of significant adverse effects could be somewhat higher (as a direct result of tanker traffic) than would be expected if a pipeline transported oil towards the Alaska Peninsula. It should be noted that although risks of oil spills to certain Bering Sea habitats apparently increase if tankering would occur as discussed here (or in Sec. IV.7.a., IV.7.b.), higher risk may be incurred at localized shorelines at the south side of the Alaska Peninsula if oil was piped to such a terminus.

However, what little data there are suggest that habitats in the latter vicinity may not be quite as important to endangered whales as to those of the Unimak Pass region. As discussed in Section IV.7.a. and IV.7.b., this transportation mode may increase the probability of localized disturbance on effects of cetaceans in the Unimak Pass region.

Conclusion: Probability of interaction of oilspills and endangered species would be higher and probability of significant interaction would be higher than as discussed in Section IV.B.1.d.

Effect of Additional Mitigating Measures: See Section IV.B.1.d.

Cumulative Effects: See Section IV.B.1.d.

Unavoidable Adverse Effects: See Section IV.B.1.d.

(2) Impacts on Social Systems:

(a) Impacts on Population: Over the [illegible] the field, however, both communities would accomodate reduced OCS population, ranging from 15 to 20 percent less in Unalaska, and 70 to 75 percent less in Cold Bay. As a proportion of total population, OCS population in the long-term would be comparable to that described for the south side of the Alaska Peninsula scenario in Unalaska and represent less than half the proportion (approximately 20% vs. 45-55%) of the south Alaska Peninsula scenario in Cold Bay. Population effects on the Pribilof Islands, although numerically somewhat larger (approximately 20 vs. less than 10), would be comparable with those described in Section IV.B.2.a.

Conclusion: The likelihood of population interaction and the potential for social effects based on the characteristics of the population are the same as described for the south side of the Alaska Peninsula scenario. The probability of significant impacts should interaction occur, defined as an added 30 percent component of total population at any point in time, is unlikely in Cold Bay and Unalaska and on the Pribilof Islands. Consequently, the probability of significant population impacts from the proposal are unlikely in Cold Bay and Unalaska and on the Pribilof Islands.

Effect of Additional Mitigating Measures: Same as described for the south side of the Alaska Peninsula scenario.

Cumulative Effects: The effect of the state onshore lease sale in Bristol Bay may be to encourage additional terminal facilities in the area, such as a south peninsula site. Otherwise, cumulative effects are the same as described for the south side of the Alaska Peninsula scenario.

Unavoidable Adverse Effects: Same as those described for the south side of the Alaska Peninsula scenario.

(b) Impacts on Subsistence Patterns: Population effects on subsistence resources should be the same as described in Section IV.B.2.b. in Cold Bay, Unalaska and the Pribilof Islands. Potential risks from oilspills to subsistence resources of the villages located west of Unimak Pass are increased by this scenario. Risks from oil pollution incidents are the same as described in Section IV.B.2.b. for the Pribilof Islands and essentially the same west of Unimak Pass, with the exception of Nikolski. The exception is considered the same as discussed in Section IV.B.7.a. for the Pribilof Islands terminal scenario. Impacts to the subsistence resources of False Pass and Nelson Lagoon should be the same as described for the south side of the Alaska Peninsula scenario.

Conclusion: Same as in Section IV.B.2.b.

Effect of Additional Mitigating Measures: The potential mitigating measure of an orientation program and the Information to Lessees on bird and marine mammal protection may reduce to an unknown extent the probability of short-term adverse interaction.

Cumulative Effects: Other Federal offshore lease sales in the Bering Sea could increase the risk to subsistence resources north and south of the Alaska Peninsula through increased tankering activity through Unimak Pass or from a south peninsula terminal; otherwise, cumulative effects would be the same as described for the south Alaska Peninsula scenario (see Sec. IV.B.2.b.).

Unavoidable Adverse Effects: Unavoidable adverse effects on subsistence resources from construction in Unalaska would be the same as described in Section IV.B.2.b.

(c) Impacts on Fishing Village Livelihood: The pattern of oilspill risk to nearshore salmon fishing grounds is the same as described for the south side of the Alaska Peninsula scenario, with risk present within 30 days but absent within 3 or 10 days of a potential spill. The probability of risk to the Nelson Lagoon/Port Moller area (area A) is less than that mentioned in Section IV.B.2.c., changed from a medium to low probability to a low probability. Risk associated with the False Pass area (area B) is the same as in Alternative I, changed from a meduim to a high probability of risk within 30 days of a spill.

Conclusion: Same as Section IV.B.2.c.

Effect of Additional Mitigating Measures: Same as Section IV.B.2.c.

Cumulative Effects: Same as Section IV.B.2.c.

Unavoidable Adverse Effects: Same as Section IV.B.2.c.

(d) Impacts on Sociocultural Systems: Population effects in Cold Bay would be reduced by approximately 50 percent, thus reducing the likelihood of interaction from OCS development and the potential for long-term change in local sociocultural systems.

Conclusion: The probability of long-term interaction of sociocultural systems with OCS-induced effects is likely in Unalaska and Cold Bay and unlikely on the Pribilof Islands. The probability of significant impacts, defined as the displacement of existing institutions of individual and social values and orientations, should interaction occur is unlikely in Unalaska, and Cold Bay and on the Pribilof Islands. Consequently, there is an unlikely probability of significant impacts on the sociocultural systems of Unalaska, Cold Bay, and the Pribilof Islands.

Effect of Additional Mitigating Measures: Same as Section IV.B.2.d.

Cumulative Effects: Same as Section IV.B.2.d.

Unavoidable Adverse Effects: Same as Section IV.B.2.d.

(e) Impacts on Community Infrastructure:

St. Paul: The housing demand could peak at 11 units, which is an increase of 275 percent over the demand experienced with development of a terminal on the south side of the Alaska Peninsula.

There is not likely to be a demand for educational facilities with development of offshore loading, which is the same demand experienced with development of a terminal on the south side of the Alaska Peninsula.

The demand for electrical power could peak at 157.5 kilowatts, which is an increase of 246 percent over the demand experienced with development of a terminal on the south side of the Alaska Peninsula. Water consumption demands could peak at 7,251,090 liters (1,916,250 gals), which is an increase of 247 percent over the demand experienced with development at a bay on the south side of the Alaska Peninsula. The sewage system demand could peak at 2,486 liters (656 gals) per day, which is an increase of 247 percent over the demand experienced with development at a bay on the south side of the Alaska Peninsula. The solid waste disposal demand could peak at 37,279 kilograms (82,015 lbs) annually, which is an increase of 247 percent over the demand experienced with development of a terminal on the south side of the Alaska Peninsula.

The demand for health care services would be the same as experienced with development at a bay on the south side of the Alaska Peninsula. The demand for police and fire protection would be the same as experienced with development at a bay on the south side of the Alaska Peninsula. The demand for communication facilities could peak at 13 additional lines, which is an increase of 260 percent over the demand with development at a bay on the south side of the Alaska Peninsula.

Unalaska: The housing demand could peak at 101 units, which is a decrease of 77 percent under the demand experienced with development at a bay on the south side of the Alaska Peninsula.

There could be a slight increase of one more classroom for educational facilities than experienced with development of a bay on the south side of the Alaska Peninsula.

The demand for electrical power could peak at 1,241 kilowatts, which is a decrease of 87 percent under the demand experienced with development at a bay on the south side of the Alaska Peninsula. Water consumption demands could peak at 57,145,495 liters (15,101,875 gals) annually, which is a decrease of 87 percent under the demand experienced with development at a bay on the south side of the Alaska Peninsula. The sewage system demand could peak at 19,583 liters (5,173 gals) per day, which is a decrease of 87 percent under the demand experienced with development at a bay on the south side of the Alaska Peninsula. The solid waste disposal demands could peak at 293,800 kilograms

(646,360 lbs) annually, which is a decrease of 87 percent under the demands experienced with development at a bay on the south side of the Alaska Peninsula.

The demand for health care services could peak at three additional physicians, which is an increase of 300 percent over the demand experienced with development at a bay on the south side of the Alaska Peninsula.

The demand for police protection could peak at a total of twelve officers, which is an increase of 150 percent over the demand experienced with development at a bay on the south side of the Alaska Peninsula. The demand for fire protection could be the same as experienced with development at a bay on the south side of the Alaska Peninsula. The demand for communication facilities could peak at 102 lines, which is a decrease of 72 percent under the development at a bay on the south side of the Alaska Peninsula.

Cold Bay: The housing demand could peak at 66 units, which is a decrease of 35 percent under the demands experienced with development at a bay on the south side of the Alaska Peninsula.

There is not likely to be a demand for educational facilities with development of offshore loading, which is the same demand experienced with development at a bay on the south side of the Alaska Peninsula.

The demand for electrical power could peak at 877 kilowatts, which is a decrease of 24 percent under the demands experienced with development at a bay on the south side of the Alaska Peninsula.

Water consumption demand could peak ar 40,398,930 liters (10,676,250 gals) annually, which is a decrease of 33 percent under the demand experienced with development at a bay on the south side of the Alaska Peninsula. The sewage system demands could peak at 13,854 liters (3,657 gals) per day, which is a decrease of 78 percent under the demand experienced with development at a bay on the south side of the Alaska Peninsula. The solid waste disposal demand could peak at 569 kilograms (1,251 lbs) per day, which is a decrease of 110 percent under the demand experienced with development at a bay on the south side of the Alaska Peninsula.

The demand for health care services would peak at a total of one physician, which is a decrease of 50 percent under the demand experienced with development at a bay on the south side of the Alaska Peninsula. The demands for police and fire protection could be the same as experienced with development at a bay on the south side of the Alaska Peninsula. The demand for communication facilities could peak at 72 lines, which is a decrease of 67 percent under the demand experienced with development at a bay on the south side of the Alaska Peninsula.

Conclusion: St. Paul may be able to adequately support the changes in the demand for educational facilities, electrical power, health service, and police protection; however, the community would need to provide additional facilities to meet the demands for housing, water, sewage, solid waste, fire protection, and communication facilities.

Unalaska may be able to adequately support the changes in demand for housing, educational, solid waste disposal, and communication facilities; however, the community would need to provide additional facilities to meet the demands for electrical power, water, sewage, health care, and police and fire protection facilities.

Cold Bay may be able to adequately support the changes in the demand for education, electrical power, water, fire protection and communication facilities; however, the community would need to provide additional facilities to meet the demands for housing, sewage, solid waste disposal, health services, and police protection.

Effect of Additional Mitigating Measures: The mitigating measures described as effective for development of a bay on the south side at the Alaska Peninsula would also be effective for development of offshore loading and tankering (see Sec. IV.B.2.e.).

Cumulative Effects: The cumulative effects identified as affecting the communities with development at a bay on the south side of the Alaska Peninsula would also be apparent with development of offshore loading and tankering (see Sec. IV.B.2.e.).

Unavoidable Adverse Effects: The unavoidable adverse effects would be the same with development of offshore loading and tankering as with development at a bay on the south side of the Alaska Peninsula (see Sec. IV.B.2.e.).

(3) Impacts on Cultural Resources: Offshore loading would endanger onshore cultural resources in the Unimak Pass area to a greater extent than could pipeline transportation to the south side of the Alaska Peninsula. There is a greater danger of oilspills from tanker accidents associated with offshore loading which would impact cultural resources such as burins, middens, arrowheads, etc., located along the coast.

Conclusion: Impacts from offshore loading and tankering to cultural resources would be greater than described for the south Alaska Peninsula scenario.

Effect of Additional Mitigating Measures: Same as Section IV.B.3.

Cumulative Effects: Same as Section IV.B.3.

Unavoidable Adverse Effects: Same as Section IV.B.3.

(4) Impacts on Economic Conditions: OCS employment impacts in the Aleutian Islands Census Division resulting from this scenario are presented in Table IV.B.4.b.-7. Employment impacts on individual communities are provided in Appendix Tables G-10 through G-12. Employment projections in the OCS and non-OCS cases are compared in Tables IV.B.4.b.-2 through -4 for the census division, and in Appendix Tables G-13 through G-15 for individual communities.

This scenario differs substantially from the south side of the Alaska Peninsula scenario by creating a total employment impact of only 4,313 additional jobs in the peak year of 1987 compared to 6,399 new jobs in the south side scenario. However, this difference does not alter the major conclusions regarding the economic impacts of OCS development.

Conclusion: See Section IV.B.4.b.

Effect of Additional Mitigating Measures: See Section IV.B.4.b.

Cumulative Effects: See Section IV.B.4.b.

Unavoidable Adverse Effects: See Section IV.B.4.b.

(5) Impacts on Transportation Systems:

St. Paul Island:

Impacts on Air Facilities: The impact of an offshore loading scenario on the transportation systems of St. Paul Island would be greater than those forecast for St. Paul Island under the south Alaska Peninsula scenario. Annual enplanements during the peak of offshore activities would be approximately 13,000. This figure would be nearly 3 times the amount expected for the baseline year 1987 and 15 times greater than the traffic forecast for the same year under the south Alaska Peninsula scenario. Such a traffic increase and attendant cargo requirments would result in a construction effort similar to that described for the other scenarios. Production phase transportation requirements for the Pribilof Islands, specifically St. Paul, would continue through the life of the field. During peak production activity, annual enplanements would reach of approximately 3,000 personel. This figure contrasts with production phase enplanements described for the south Alaska Peninsula scenario (zero). It is probable that an air support base of some type would be established on St. Paul Island. During the exploratory and developmental periods, helicopter traffic would be similar to that described for the St. Paul Island terminal scenario.

Impact on Marine Facilities: Impacts on any existing marine facilities at St. Paul are expected to be nonexistent as marine support for this alternative is expected to issue entirely from Unalaska/Dutch Harbor.

Dutch Harbor/Unalaska:

Impacts on Air Traffic Facilities: Impacts which would occur to air traffic systems under this alternative are expected to be minimal. During the maximum year of OCS developmental activities, enplanement could be approximately 5,500 personnel. Thus, the air facilities of Unalaska/Dutch Harbor are not expected to be taxed and should easily accommodate the air traffic. However, some renovation of existing storage facilities or construction of additional warehouse space may be needed.

Impacts on Marine Facilities: The impacts on marine facilities under this transportation scenario would not be substantially different from those described for the south Alaska Peninsula scenario.

Unimak Pass: An offshore loading scenario would entail the use of Unimak Pass by crude or LNG carriers, unlike the transportation scenario associated with the proposed action. Daily tanker traffic which would result from this transportation scenario is somewhat difficult to estimate as it would depend entirely on where the offshore loading platform(s) was enplaced. The location of the offshore loading complex in a more southerly position would facilitate the use of the complex by large crude carriers on a year round basis. This would have the tendency to cut tanker trips through the pass. Location of the complex in a more northerly position would increase the chances for delay of traffic due to ice and necessary employment of icebreaking tankers. These tankers as a rule would be smaller than a non-icebreaking tanker and trips through the Unimak Pass region would increase. Thus the range for maximum potential traffic during peak production under this scenario through the Unimak Pass ranges from a low of 210 vessels to a high of 444 vessels.

Cold Bay:

Impacts on Air Facilities: During the exploratory and production phases, impacts on Cold Bay's airfield would be similar to those described for the south Alaska Peninsula scenario. However, during the developmental period, enplanements could decline by 30 to 50 percent compared to the south Alaska Peninsula scenario. This reduction of enplanements would not require the construction of a large ancillary complex of living and dining quarters. However, impacts which would result under this transportation scenario would still be significant enough to require upgrading of attendant aircraft maintenance facilities and possible re-evaluation of existing navigational aids.

Conclusion: The implementation of this transportation scenario would result in no reduction of marine transportation impacts compared to the south Alaska Peninsula scenario. Impacts on air transport systems of St. Paul Island, Unalaska/Dutch Harbor, and Cold Bay under this transportation scenario would be reduced from that of the south Alaska Peninsula scenario (See Table IV.B.5-1). This reduction is particularly evident during the peak of developmental activities. The impact of an offshore loading scenario on the air transportation facilities of St. Paul Island would be greater than those forecast under the south Alaska Peninsula scenario.

Effect of Additional Mitigating Measures: Refer to Section IV.B.5.

Cumulative Effects: Refer to Section IV.B.5.

Unavoidable Adverse Effects: Refer to Section IV.B.5.

(6) Impacts on Coastal Zone Management: The proposal, with development of offshore loading and tankering, is not expected to adversely affect a potential district Coastal Management Program in the Aleutian/Pribilof Islands region. Impacts to the region would differ with offshore development as opposed to development of a terminal on the south side of the Alaska Peninsula, in that OCS activities and facilities are not as likely to impact areas within the district CMP boundaries.

Conclusion: Development of offshore loading and tankering would create impacts to the CMPs different from those if a terminal on the south side of the Alaska Peninsula were developed.

Effect of Additional Mitigating Measures: The mitigating measures suggested as effective for development of a terminal on the south side of the Alaska Peninsula would also be effective for development of offshore loading and tankering, assuming those activities were within the boundaries of the CMPs.

Cumulative Effects: Cumulative effects upon the district CMPs in the Aleutian/Pribilof Islands area would be the same as those experienced if a terminal on the south side of the Alaska Peninsula were developed.

Unavoidable Adverse Effects: The development of offshore loading and tankering may create the same unavoidable adverse effects as those experienced with development of a terminal on the south side of the Alaska Peninsula.

C. Alternative II - No Sale

1. Impacts on Biological Resources:

a. **Impacts on Fisheries:** Without the proposed sale in the St. George Basin, the probability of adverse impacts on fisheries would be eliminated. The fisheries resources would continue to be used by man and no additional stress would be placed on this ecosystem.

Commercial fishing, both by American and foreign interests would continue without the possibility of area and material conflicts, loss, or damage.

b. **Impacts on Marine and Coastal Birds:** There would be no adverse impacts or unavoidable adverse effects on the St. George Basin or adjacent land areas as a result of this alternative. Refer to Section IV.B.1.b. for a discussion of cumulative effects which may result from other sources.

c. **Impacts on Marine Mammals:** There would be no adverse impacts or unavoidable adverse effects on the St. George Basin or adjacent land areas as a result of this alternative. Refer to Section IV.B.1.c. for a discussion of cumulative effects which may result from other sources.

d. **Impacts on Endangered Species and Non-Endangered Cetaceans:** There would be no adverse impacts or unavoidable adverse effects on endangered species or non-endangered cetaceans as a result of this alternative. Refer to Section IV.B.1.d. for a discussion of other cumulative factors which may affect such species.

2. Impacts on Social Systems:

a. **Impacts on Population:** There would be no adverse impacts or unavoidable adverse effects on the Aleutian-Pribilof Islands region as a result of this alternative. Refer to Section III.C.1.c. for a discussion of the potential future effects of population growth resulting from rapid development of the bottomfishing industry and to Section IV.B.2.a. for an evaluation of potential cumulative effects from other projects anticipated to occur in the region.

b. **Impacts on Subsistence:** There would be no adverse impacts or unavoidable adverse effects on the Aleutian-Pribilof Islands region as a result of this alternative. Refer to Section III.C.2.c. for a discussion of potential future effects on subsistence from the rapid development of the bottomfishing industry and to Section IV.B.2.b. for an evaluation of potential cumulative effects from other projects anticipated to occur in the region.

c. Impacts on Fishing Village Livelihood: There would be no adverse impacts or unavoidable adverse effects on the Aleutian-Pribilof Islands region as a result of this alternative. Refer to Section III.C.1.c. (population) for a discussion of the basis for future growth in selected fishing villages and to Section IV.B.2.c. for an evaluation of potential cumulative effects from other projects anticipated to occur in the region.

d. Impacts on Sociocultural Systems: There would be no adverse impacts or unavoidable adverse effects on the Aleutian-Pribilof Islands region as a result of this alternative. Refer to Section III.C.4.f. for a discussion of potential future effects on sociocultural systems from the rapid development of the bottomfishing industry and to Section IV.B.2.d. for an evaluation of potential cumulative effects from other projects anticipated to occur in the region.

e. Impacts on Community Infrastructure: Under the no sale alternative, impacts to the area would primarily result from normal growth and the bottomfishing industry projections. In the absence of the proposed lease sale, the impacts, cumulative effects and the unavoidable adverse effects from the sale are eliminated.

St. Paul: St. Paul is estimated to need new housing units only to relieve overcrowding and replacement of obsolete housing. Acreage is available to accommodate new dwellings. The educational facilities are estimated to be adequate for the indefinite future as enrollment is expected to stabilize at a total of 105 students (63 elementary and 42 secondary). The electrical power system is adequate and can accept a modest increase. With the addition of a bottomfish plant, an additional 3,000 to 4,000 kilowatt generating capacity may be required for residential and industrial use. Water consumption is expected to remain relatively stable, although bottomfish industry demand would nearly triple the level of domestic water consumption by 1990. The sewage system may also experience a tripling in volume of domestic sewage if the bottomfishing industry is established. The estimated domestic daily treatment capacity could be expected to move from 249,837 liters (66,000 gal) per day in 1985 to 673,803 liters (178,000 gal) per day in 1990 through 2000. Future increases could be expected in solid waste disposal of 544,311 kilograms (600 tons) annually in 1985 and 1,551,286 kilograms (1710 tons) annually from 1990 to 2000. The main need will be for equipment to run the disposal system. St. Paul estimates that the existing health services should continue to be adequate for additional increases if the bottomfish plant has a small clinic associated with it. Police protection is estimated to be adequate until construction of the bottomfish plant, when an additional two positions would be needed. Fire protection is inadequate in terms of equipment, but there is an adequate number of volunteer firefighters. St. Paul might need a new communications system consisting of an on-line distribution system of approximately 200 lines by 1985.

Unalaska: The housing demand at Unalaska is estimated to be fairly substantial, with a possible 3,400 units being demanded between 1985-2000. The heaviest demand of 1,242 dwellings is estimated for 1991-1995. Required acreage to house the demand is estimated at 500 plus acres. Unalaska's educational needs are estimated to double in 1985, 1990, and 2000 to reach an approximate level of 1,000 elementary and 700 secondary students in 2000. This demand could require an estimated 20 new classrooms between 1985 and

1990; 25 more by 1995 and an additional 14 classrooms by 2000. The future electrical power requirements for residential and industrial (primarily bottomfish industry) use are expected to almost double by 1990 to 25,000 kilowatts (kw) and to double again by 2000 to 50,000 kilowatts. The system, which is currently inadequate, would be very inadequate with those increased loads. The future domestic water demand is estimated to grow to 6,245,929 liters (1,650,000 gal) per day in 2000. The water treatment facilities, development of existing surface water sources, added water storage capacity, transmission and distribution lines may need improvement. The sewage system, inadequate at the present, is expected to be replaced with a design capacity of 3,028,329 liters (800,000 gal) per day in 1990 and 6,245,929 liters (1,650,000 gal) per day in 2000. The solid waste disposal system may need a private or public organization to provide a collection service for the estimated 3,057,213 kilograms (3,370 tons) in 1985, 6,849,245 kilograms (7,550 tons) in 1990, 11,548,462 kilograms (12,730 tons) in 1995 and 14,424,237 kilograms (15,900 tons) in 2000. To maintain adequate health care, Unalaska might need several full-time doctors and dentists plus a 12 bed hospital by 1985. The demand by 2000 could justify approximately 12 doctors and dentists and a 40-50 bed hospital. Police protection for Unalaska may need to be increased by an additional ten police officers during each five year interval from 1980 to 2000. The fire department could need several additional stations to provide adequate response time with the increased residential and industrial development forecast for the area. The communications system is estimated to be adequate through 1985 and increases past 1985 are not expected to present noteworthy difficulties.

Cold Bay: The housing demand at Cold Bay is estimated to be an additional 175 units over the next 20 years, primarily in private rather than group housing. The projected required acreage is approximately 26 acres. Educational enrollment could be expected to increase to a total of 66 in 1985, 84 in 1990, 106 in 1995 and 129 in 2000. Additional classrooms may be needed, with approximately three in 1990, four in 1995 and five in 2000. Electrical power requirements are estimated to be adequate until 1985, with a possible demand of 2500 kilowatts required by 2000. Domestic water consumption for Cold Bay could increase nearly threefold over the next 20 years. The total domestic capacity is estimated to be 158,987 liters (42,000 gal) per day in 1985, 200,626 liters (53,000 gal) in 1990; and 306,618 liters (81,000 gal) per day in 2000. Increases in the sewage system capacity are expected to be 158,987 liters (42,000 gal) by 1995, and 306,618 liters (81,000 gal) per day by 2000. Estimated annual tonnage for solid waste disposal is expected to run from 344,730 kilograms (380 tons) in 1985 to 459,943 kilograms (507 tons) in 1990, 578,784 kilograms (638 tons) in 1995 and 704,882 kilograms (777 tons) in 2000. The health service demands are likely to require a permanent Public Health Service nurse and a community clinic, supplemented by periodic visits from itinerant physicians and dentists by 1990. Police protection in the form of a State Trooper could be needed by 1990 and an additional three-cell facility by 2000. Fire protection is likely to be adequate with the exception of upgrading the water distribution system. Communications may need increasing to 220 telephone hookups by 2000 to provide adequate service. This could be accomplished through extension of the existing lines.

Conclusion: St. Paul should not experience any major adverse social impacts from this Alternative and the willingness from local residents to provide local control will help to accomplish a smooth adjustment. The infrastructure growth should be relatively stable over the next two decades. Under this Alternative, the probability of an interaction between infrastructure impacts and oil and gas development is very unlikely. The probability of a significant impact if there is an interaction is also very unlikely. The overall probability of a significant interaction is very unlikely.

Unalaska will most likely experience acute problems of growth management, primarily associated with an increase in bottomfishing activity in the area. The heaviest impacts could be to housing, sewage, electrical power and water supply. The probability of an interaction between infrastructure and oil and gas development is very unlikely. The probability of a significant impact if the interaction does occur is very unlikely. The overall probability of a significant interaction is very unlikely.

Cold Bay should not experience major adverse impacts to the community infrastructure. The most serious impact could be the lack of a local government or other government agency with responsibility to oversee all the central community development needs. The no sale alternative creates a very unlikely probability of an interaction that would impact community infrastructure as a result of oil and gas development. The probability of a significant impact occurring if there is an interaction is also very unlikely. The overall probability of a significant interaction is very unlikely.

Effect of Additional Mitigating Measures: The proposed mitigating measures would not be appropriate in the absence of the proposal.

Cumulative Effects: The effect of the St. Paul small boat harbor, Unalaska small boat harbor, the Cherinofski fishing community and the Unalaska Airport expansion would act to increase and perhaps hasten growth in the specific communities associated with each project.

Unavoidable Adverse Effects: In the absence of the sale, there would be no unavoidable adverse effects, except from the rapid increases in growth resulting from the proposed bottomfishing industry.

3. Impacts on Cultural Resources: Cultural resources will be impacted by any other projects such as bottomfishing. There would be no adverse, cumulative or unavoidable impacts as a result of this alternative.

4. Impacts on Economic Conditions:

a. Impacts on State and Regional Economies: The economic impact of proposed OCS petroleum development activities is expected to be minor in areas of Alaska other than the Aleutian Islands Census Division in which the development would occur. For that reason, this DEIS does not discuss the statewide and regional economic impacts.

b. Impacts on Local Economy (Defined as the Economy of the Aleutian Islands Census Division, with Emphasis on Selected Communities): Future employment and population levels are presented in Table III.E.2.-7, "Population and Employment Projections in the Absence of OCS Activity/Aleutian Islands Census Division 1981-2000."

5. Impacts on Transportation Systems: This alternative would result in no impacts to the transportation systems of affected areas above what has been forecast for the baseline condition.

6. Impacts on Coastal Zone Management: The no sale alternative would not create impacts or unavoidable adverse effects on the district Coastal Management Programs once they are completed for the Aleutian/Pribilof Islands area. The bottomfishing industry is not likely to create substantial impacts on the district Coastal Management Program. Development associated with the bottomfishing industry would need to be in accordance with the plans once the CMP is approved. Without concrete goals and objective statements available at this time, it would be difficult to predict the specific degree of impact or conflict between the bottomfishing industry and the coastal management program. Refer to Section IV.B.6. for a discussion of the cumulative effects which could result from other projects (as described in Sec. IV.A.7.).

D. Alternative III - Delay the Sale

1. Impacts on Biological Resources:

a. Impacts on Fisheries: Delay would postpone the impacts identified and discussed in Section IV.B.1.a. Lessening of adverse impacts due to time available for additional studies and improved technology for control of oil pollution and cleanup, with resultant increased knowledge of interactions between oil development and fish resources may accrue. These are probabilities only. Delaying the sale could preclude use of the South Alaska Peninsula for oil transport facilities and concurrently abate fisheries impacts.

Conclusion: Delaying this sale may cause some further reduction in already minor adverse impacts on fisheries, basically reduction in oilspill risk probability.

Effect of Additional Mitigating Measures: Mitigating measures applicable to the proposal would still apply should this sale be held at a later date, delay would result in no foreseeable change in these measures, nor is it likley that delay would necessitate incorporation of additional mitigation.

Cumulative Effects: Delay of the sale would only postpone the cumulative effects discussed by the proposal.

Unavoidable Adverse Effects: These, discussed by the proposal, might be reduced as additional information is gained during the delay period; or conversely becomes more severe as a result of this additional data collection.

Impacts on Commercial Fishing: Sale delay could have some effect on commercial fishing; adverse impacts might be increased should the fishery expand greatly during the delay period, this could result from expanded American participation in the eastern Bering Sea bottomfish fishery or by exploitation of a now not utilized fish species. Some present impacts on the commercial fishing operations could be reduced, e.g. improvement in navigational procedures to reduce gear loss and vessel collisions.

Conclusion: Sale delay could reduce some impacts on commercial fishing; could increase others. Specifics and degree cannot be determined at this time.

Effect of Additional Mitigating Measures: Mitigating measures to protect the interests of commercial fishermen, i.e., the orientation program, would have the same effect as described for the proposal. Increased knowledge of the region, gained during the delay period, might dictate additional mitigating measures. This cannot be assessed at this time.

Cumulative Effects: Delaying this sale could result in the cumulative impacts and related mitigating measures being better delineated, reducing impacts on commercial fishing.

Unavoidable Adverse Effects: Some adverse impacts would be postponed were the sale delayed. Some adverse effects could be reduced or even eliminated as additional information is gained during the period of delay. Adverse impacts on commercial fishing could increase should commercial fishing operations expand in the lease area during delay of the sale.

b. Impacts on Marine and Coastal Birds: Potential impacts associated with this alternative would be qualitatively the same as those described for the proposal (Sec. IV.B.1.b.), but would occur at some later time. The magnitude of effects could vary depending upon population status of affected species at the time such delay terminates. Delay of the sale would provide additional time for ongoing and proposed research to acquire data useful in improving the accuracy and precision of prediction relative to marine and coastal birds.

Conclusion: Under this alternative, the same impacts as described under the proposal would occur, but later in time.

Effect of Additional Mitigating Measures: Refer to the discussion under the proposal (Sec. IV.B.1.b.).

Cumulative Effects: Cumulative effects would essentially be the same as discussed under the proposal (Sec. IV.B.1.b.), but could vary depending on the population status of affected species.

Unavoidable Adverse Effects: Refer to discussion for the proposal (Sec. IV.B.1.b.).

c. Impacts on Marine Mammals: Potential impacts associated with this alternative would be qualitatively the same as those described for the proposal (Sec. IV.B.1.c.), but would occur at some later time. The magnitude of effects could vary depending upon population status of affected species at the time such delay terminates. Delay of the sale could provide additional time for ongoing and proposed research to acquire data useful in improving the accuracy and precision of prediction relative to marine mammals.

Conclusion: Under this alternative, the same impacts as described for the proposal would occur, but later in time.

Effect of Addtional Mitigating Measures: Refer to the discussion for the proposal (Sec. IV.B.1.c.).

Cumulative Effects: Cumulative effects would be essentially the same as discussed for the proposal (Sec. IV.B.1.c.), but could vary depending on the population status of affected species.

Unavoidable Adverse Effects: Refer to discussion under the proposal (Sec. IV.B.1.c.).

d. Impacts on Endangered Species and Non-Endangered Cetaceans: Effects associated with this alternative would be essentially the same, at least qualitatively, as those discussed for the proposal (see Sec. IV.B.1.d. for a discussion of potential types of direct and indirect effects which may be sustained by endangered species and non-endangered cetaceans). The magnitude of effects could vary depending upon population status or affected species at the time such delay would terminate, or when undesirable effects would occur. Delay of sale would provide additional time for ongoing research to acquire additional data useful in improving the accuracy and precision of impact prediction.

Conclusion: See preceding paragraph and Section IV.B.1.d.

Effect of Additional Mitigating Measures: See Section IV.B.1.d.

Cumulative Effects: See Section IV.B.1.d.

Unavoidable Adverse Effects: See Section IV.B.1.d.

2. Impacts on Social Systems:

a. Impacts on Population: Refer to the discussion of population impacts for the proposal in Section IV.B.2.a. Population impacts from this alternative would be the same as the proposal, only delayed.

Conclusion: Population impacts are the same as the proposal, only delayed.

Effect of Additional Mitigating Measures: Same as the proposal.

Cumulative Effects: Same as the proposal.

Unavoidable Adverse Effects: Same as the proposal.

b. Impacts on Subsistence: Refer to the discussion of impacts to subsistence for the proposal in Section IV.B.2.b. Impacts on subsistence from this alternative would be the same as the proposal, only delayed.

Conclusion: Subsistence impacts are the same as the proposal, only delayed.

Effect of Additional Mitigating Measures: Same as the proposal.

Cumulative Effects: Same as the proposal.

Unavoidable Adverse Effects: Same as the proposal.

c. Impacts on Fishing Village Livelihood: Refer to the discussion of impacts to fishing village livelihood for the proposal in Section IV.B.2.c. Impacts on fishing village livelihood from this alternative would be the same as the proposal, only delayed.

Conclusion: Fishing village livelihood impacts would be the same as the proposal, only delayed.

Effect of Additional Mitigating Measures: Same as the proposal.

Cumulative Effects: Same as the proposal.

Unavoidable Adverse Effects: Same as the proposal.

d. Impacts on Sociocultural Systems: Refer to the discussion of impacts to sociocultural systems for the proposal in Section IV.B.2.d. Impacts on sociocultural systems from this alternative would be the same as the proposal, only delayed.

Conclusion: Sociocultural systems impacts would be the same as the proposal, only delayed.

Effect of Additional Mitigating Measures: Same as the proposal.

Cumulative Effects: Same as the proposal.

Unavoidable Adverse Effects: Same as the proposal.

e. Impacts on Community Infrastructure: Delaying the sale for a period of 2 years would delay the impacts as previously described in Section IV.B.2.e. However, the delay could provide the communities with additional time to plan and prepare for the impacts discussed in Alternative I (see Sec. IV.B.2.e.). A side effect may be the increased cost of housing, residential land, labor, and material costs due to inflation.

Conclusion: Delaying the sale would provide additional time for the communities to plan and prepare for possible impacts from the sale. The impacts would most likely be the same as those described in the proposal. The probabilities of interactions and significant impacts would remain the same as described in Alternative I, only delayed 2 years.

Effect of Additional Mitigating Measures: The effectiveness of the mitigating measures would be the same as described in Section IV.B.2.e.

Cumulative Effects: The effects from the cumulative projects described in Section IV.A.7. would be the same as described in Section IV.B.2.e.

Unavoidable Adverse Effects: The unavoidable adverse effects would be the same as described in Section IV.B.2.e., only delayed 2 years.

3. Impacts on Cultural Resources: Delaying the sale would not only delay impacts on cultural resources but would also allow more time for avoidance or surveying, which would lower the probability of interactions slightly.

Conclusion: This alternative would lower the probability of significant impact to cultural resources to unlikely.

Effect of Additional Mitigating Measures: Same as the proposal.

Cumulative Effects: Delaying the sale would delay the addition of the proposal impacts to impacts of other projects. This would lower the cumulative impacts to unlikely.

Unavoidable Adverse Effects: Delaying the sale would lower the probability of unavoidable adverse impact to very unlikely.

4. Impacts on Economic Considerations:

a. Impacts on State and Regional Economies: The economic impact of proposed OCS petroleum development activities is expected to be minor in areas of Alaska other than the Aleutian Islands Census Division in which the development would occur. For that reason, this DEIS does not discuss the statewide and regional economic impacts.

b. Impacts on Local Economy (Defined as the Economy of the Aleutian Islands Census Division, with Emphasis on Selected Communities: Employment and population impacts presented in Tables IV.B.4.b.-1 through IV.B.4.b.-4 would be delayed.

Conclusion: See preceding paragraph.

Effect of Additional Mitigating Measures: Refer to Section IV.B.4.b.

Cumulative Effects: Refer to Section IV.B.4.b.

Unavoidable Adverse Effects: Refer to Section IV.B.4.b.

5. Impacts on Transportation Systems: Delaying the sale by 2 years would not lessen the preceived impacts as stated in Section IV.B.5. Additional time may allow the communities to further upgrade their facilities; however, should the proposed action occur as scheduled, there will be sufficient time for most of the projects outlined in the cumulative effects section to be completed before the onset of developmental activities.

Conclusion: There would be no change in impacts from those outlined in Section IV.B.5.

Effect of Additional Mitigating Measures: There would be no change from Section IV.B.5.

Cumulative Effects: There would be no change from Section IV.B.5.

Unavoidable Adverse Effects: There would be no change from Section IV.B.5.

6. Impacts on Coastal Zone Management: Delaying the sale could have some effect upon the CMP of the Aleutian/Pribilof Islands area, since the delay could allow enough time for the Aleutian/Pribilof Islands to complete their CMP's. Completion of the CMP's could influence the siting of explora-

tion, development, and production activities and facilities. Without concrete goals and objective statements available at this time, it would be difficult to predict the degree of impact or conflict between OCS program and activities and the district CMP.

Conclusion: Under this alternative, impacts would be nearly the same as with the proposal, only delayed 2 years (see Sec. IV.B.6.).

Effect of Additional Mitigating Measures: Those mitigating measures proposed as effective for the proposal would be useful for mitigating the effects of this alternative also (see Sec. IV.B.6.).

Cumulative Effects: Cumulative effects would be very similiar to those described in the proposal, only delayed 2 years. It is possible that some projects, e.g., Unalaska airport expansion, St. Paul small boat harbor, would be completed, or nearly so, in two years (see Sec. IV.B.6.).

Unavoidable Adverse Effects: Unavoidable adverse effects would be almost the same as for the proposal, only delayed 2 years (see Sec. IV.B.6.).

E. Alternative IV - Deletion near Pribilof Islands

Modification of the proposal by the deletion of 73 blocks located near the Pribilof Islands. Refer to Section II.B.4. for a complete description of this alternative.

1. Impacts on Biological Resources:

a. Impacts on Fisheries: The nearshore waters around the Pribilof Islands contain relatively large populations of blue king crab and Korean horsehair crab and smaller numbers of Pacific cod and flounders other than halibut and yellowfin sole. While low in number, based on NMFS surveys, there are sufficient halibut to support a small-boat commercial fishery by the islanders. Halibut are also an important subsistence food.

Of particular importance is the developing fishery for the Korean horsehair crab. This species is located in relatively shallow areas from June through September at depths of 18 to 20 fathoms (108-120 ft); however, pelagic larvae dwell at shallower depths and could be vulnerable to oilspills.

Oilspills in excess of 1,000 barrels reaching nearshore areas of the Pribilofs could prove damaging to larval Korean horsehair and blue king crabs. Pacific cod and the flounder, found here mainly as demersal adults, would not likely be significantly affected.

Deletion of these blocks would reduce oilspill risk probability for an oilspill of 1,000 barrels or more reaching the Pribilofs over a 10-day or 30-day period from the proposal's 8-percent to 4-percent and would, thus, reduce the probability of adverse impacts on the blue king crab and the Korean horsehair crab. Demersal finfish species would not benefit directly from this deletion; contact with oil by either adults or larval forms is not probable.

There would be no adverse impacts on the five species of Pacific salmon which dwell near the area included in this alternative. Their migratory routes lie outside the area and this general area has not been identified as a rearing area for salmonids.

Conclusion: This deletion affords minor protection from oilspills reaching the Pribilof Islands and the blue and Korean horsehair crabs inhabiting, spawning, and rearing near the islands. This alternative would reduce the probability of interaction of spilled oil and fisheries resources located in the nearshore area of the Pribilof Islands to very unlikely. The significance, if interaction took place, would be likely. Overall, the probability of significant impact in the Pribilof Islands area would be unlikely.

Effect of Additional Mitigating Measures: The effectiveness of mitigating measures for this alternative would be the same as described for the proposal (see Sec. IV.B.1.a.).

Cumulative Effects: Cumulative effects on the fisheries resources of the St. George Basin and eastern Bering Sea would not change from those discussed for the proposal. Korean horsehair crab and blue king crab populations are expected to be fully exploited by the commercial fishery with some reduction in total numbers.

Unavoidable Adverse Effects: These would remain essentially the same as those discussed for the proposal.

Impacts on Commercial Fishing: St. Paul and St. George Islands are in the process of developing resident offshore commercial fisheries. These operations are being conducted in relatively nearshore waters for halibut and Korean horsehair crab. In addition, a test fishery for Pacific cod is being developed (personal communication, Larry Merculief). If a small boat harbor is constructed at St. Paul, these fisheries are projected to expand rapidly.

The developing, yet small-scale, commercial fishery by the Pribilof Islanders could be impacted by loss of fishing gear related to oil development, or by the toxic effects of oil on the larval forms of the commercial species for which they fish. Gear loss would appear the most likely adverse effect and adoption of this alternative could reduce the probability of this occurrence. Oil development vessels would be operating considerably further away from these fishing areas, thus conflicts would be greatly reduced.

Other commercial fishing fleets, American and foreign, that fish in the area included in this alternative would receive similar benefits. In addition reduction of vessel collisions would occur. Generally, however, the bulk of this fishing effort is now carried on outside this deletion.

Conclusion: This alternative affords some benefit to the Pribilof Island commercial/subsistence fishermen; both through resource protection and reduced probability of conflicts between the fishery and oil development. The probability of interaction between Pribilof fishing efforts and oil and gas activity is very unlikely. If interaction occurs, the impact would be significant, but significant impacts would be unlikely.

Effect of Additional Mitigating Measures: The effect of mitigating measures for this alternative would be the same as those described for the proposal.

Cumulative Effects: Commercial fishing effort in the vicinity of the Pribilof Islands should expand and intensify through increased availability of presently fished species or by development of a fishery on a new species, this alternative could reduce impacts on the fishery through a reduction in loss of resources, reduced loss of fishing gear, and a reduced probability of vessel collisions.

Other cumulative effects previously discussed would not be changed.

Unavoidable Adverse Effects: Unavoidable adverse effects would be similar to those described in Section IV.B.1.a. (proposal).

b. Impacts on Marine and Coastal Birds: The principal effect of deleting the northwestern blocks would be to reduce the probability of oil contact with birds foraging in the intensive-use area surrounding the Pribilof Islands. For example, probability of contact with the St. George Island area (Impact Zones 21-24) from spill points within this deletion (P_3-P_5) ranges from 49 to 66 percent, whereas probability of contact from the nearest spill points remaining after deletion of these blocks (P_6, P_8) is 35 to 46 percent. Elsewhere in the area considered, there is little difference between the proposal and this alternative in probability of interactions. Disturbance from air traffic and human presence associated with oil and gas activities could have severe impacts on production by colonial species during the nesting season, adding to any effects on the populations caused by contact with oil at sea.

Site-Specific Impacts: Contact probabilities associated with an Alaska Peninsula transportation route are not significantly different from the proposal except in the vicinity of the Pribilof Islands where probability of oilspill contact with Impact Zones 21 to 24 (St. George area) and 25 to 28 (St. Paul area) is reduced from 50 to 32 percent and 15 to 5 percent, respectively.

Conclusion: Probability of oilspill contact and potential interaction with birds is similar to the proposal except in the Pribilof Island vicinity where probabilities are reduced to unlikely or very unlikely. Because of species' sensitivity to oil, impacts are likely to be significant. The probability of significant impacts are still considered unlikely and very unlikely for the two island areas.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

c. Impacts on Marine Mammals: The principal effect of deleting the northwestern blocks is to reduce the probability of oilspill interaction with marine mammals foraging in the intensive-use area surrounding the Pribilof Islands. For example, probability of oilspill entry into the St.

George Island area (Impact Zones 21-24) from spill points within this deletion (P_3-P_5) ranges from 49 to 66 percent, whereas probability of contact from the nearest spill points remaining after deletion of these blocks (P_6, P_8) is 35 to 46 percent. Elsewhere in the area considered, there is little difference between the proposal and this alternative in probability of interactions. Disturbance from transportation activity and human presence also would decrease with this alternative. Potential disturbance and habitat degradation associated with construction of proposed projects on St. Paul and Unalaska Islands probably would not decrease with this alternative.

Site-Specific Impacts: Contact probabilities associated with an Alaska Peninsula transportation scenario are not significantly different from the proposal except in the vicinity of the Pribilof Islands where probability of oilspill contact with Impact Zones 21 to 24 (St. George area) and 25 to 28 (St. Paul area) is reduced from 50 to 32 percent and 15 to 5 percent, respectively.

Conclusion: Probability of oilspill contact and potential interaction with marine mammals is similar to the proposal except in the Pribilof Islands vicinity where probabilities are reduced to unlikely or very unlikely. Because of sensitivity to oil, impacts on sea otter and fur seal are more likely to be significant than sea lion and harbor seal. However, significant impacts are still considered unlikely and very unlikely for these two island areas.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

d. Impacts on Endangered Species and Non-Endangered Cetaceans: See Section IV.B.1.d. for a general discussion of potential direct and indirect effects of endangered species and non-endangered cetaceans. (Unless otherwise specified, oil spill risk analyses made in this section refer to probabilities conditional on the development of a production field as described in Sections II.A. and IV.A. and to associated 10-day, 1,000-barrel spill contact rates portrayed in Appendix E). Appendix E, Table 7, shows that this alternative would eliminate potential spill source points (e.g. source points P3-P5) that would entail up to a 47 percent (hypothetical target 23) conditional (if spills originated at those points) chance that spills would move toward nearshore environments of the Pribilof Islands. Assuming development and petroleum resource potential as described previously, probabilities of spills moving toward St. Paul Island would be decreased from 6 to 8 percent (Proposal, Appendix E, Table 20, hypothetical targets 26-27) to 2 to 3 percent (Alternative IV, Appendix E, Table 24, hypothetical targets 26-27) under a pipeline to the Alaska Peninsula transportation scenario. Similarly, risks to offshore areas near St. George Island would be reduced somewhat as well. Comparison of Table 32 to 28, Appendix E, show that risks to St. Paul shorelines are only slightly reduced under this alternative as compared to the proposal. In general, this alternative would not reduce oil spills risks (as compared to the proposal) to endangerd whale habitats in the southern region of the proposed sale area and Aleutian Island nearshore habitats, or offshore areas (e.g. hypothetical targets 14-17 in the central lease area). Therefore, except to the extent that certain spill points of high conditional probability affecting offshore areas near the Pribilofs would be deleted, this alternative probably would not significantly reduce overall risks to endangered species and non-endangered cetaceans as compared to the proposed. A small number of gray whales which summer near the Pribilofs and gray whales migrating south from the northern Bering Sea may be afforded a limited amount of reduced risks of interaction with oil spills as compared to the proposal.

This alternative probably would not provide a substantial reduction of potential effects of noise and disturbance on endangered species or non-endangered cetaceans as compared to that described under the proposal.

Conclusion: As evidenced by oil spill risk analyses, it is very likely that oil spills would interact with endangered species or non-endangered cetaeans and/or their habitat. Although limited localized reduction in oilspill risk or effects of noise and disturbance may be afforded by this alternative, overall probability of occurrence of significant interactions between endangered species or non-endangered cetaceans would not differ substantially from those of the proposal, e.g. significant impacts are unlikely (see Sec. IV.B.1.d.).

Effect of Additional Mitigating Measures: Analyses of the effect of mitigating measures would be essentially the same as discussed for the proposal.

Cumulative Effects: Analyses of cumulative effects on endangered species and non-endangered cetaceans would be essentially the same as discussed for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects associated with this alternative would be essentially the same as discussed for the proposal.

2. Impacts on Social Systems:

a. Impacts on Population: The amount, characteristics, and distribution of population for Alternative IV are substantially the same as the proposal (Sec. IV.B.2.a.).

Conclusion: Impacts on population are the same as the proposal.

Effect of Additional Mitigating Measures: Same as the proposal.

Cumulative Effects: Same as the proposal.

Unavoidable Adverse Effects: Same as the proposal.

b. Impacts on Subsistence: Impacts on subsistence are considered in terms of potential effects from population concentrations and oil pollution incidents. The amount, characteristics, and distribution of population for Alternative IV are substantially the same as the proposal. The results of the Oilspill Risk Analysis for this alternative, using the south peninsula terminal scenario, are the same as the proposal (Sec. IV.B.2.b.).

Conclusion: Impacts on subsistence are the same as the proposal.

Effect of Additional Mitigating Measures: Same as the proposal.

Cumulative Effects: Same as the proposal.

Unavoidable Adverse Effects: Same as the proposal.

c. Impacts on Fishing Village Livelihood: Impacts on fishing village livelihood are considered in terms of potential effects from oil pollution incidents. The results of the Oilspill Risk Analysis for this alternative, using the south peninsula terminal scenario, are the same as the proposal (Sec. IV.B.2.c.).

Conclusion: Impacts on fishing village livelihood are the same as the proposal.

Effect of Additional Mitigating Measures: Same as the proposal.

Cumulative Effects: Same as the proposal.

Unavoidable Adverse Effects: Same as the proposal.

d. Impacts on Sociocultural Systems: Impacts on sociocultural systems are contextual questions surrounding impacts potentially contributed by population concentrations and oil pollution incidents. Based on the south peninsula terminal scenario, potential effects from population and oilspill incidents for Alternative IV are substantially the same as the proposal (Sec. IV.B.2.d.).

Conclusion: Impacts on sociocultural systems are the same as the proposal.

Effect of Additional Mitigating Measures: Same as the proposal.

Cumulative Effects: Same as the proposal.

Unavoidable Adverse Effects: Same as the proposal.

e. Impacts on Community Infrastructure: This alternative, which deletes blocks near the Pribilof Islands, may slightly decrease impacts on St. Paul from those identified in Alternative I if a pipeline, terminal, and tankering operation is assumed to be located in a bay on the south side of the Alaska Peninsula. Impacts on Unalaska and Cold Bay would remain the same as identified in Alternative I.

St. Paul: The demand for housing, educational facilities, electrical power, and water and sewage systems should be within the existing and projected system capabilities, and could be 10 to 15 percent lower than those identified in Alternative I. Impacts on health services, police, and fire protection should also be within the system capabilities and may be lower than the levels identified in Alternative I. St. Paul may need to provide additional facilities to meet the demands for water, solid waste disposal, and communication facilities as identified in Alternative I.

Unalaska: Unalaska could experience levels of impacts similar to those identified for Alternative I. The impacts on housing, education, sewage, solid waste disposal, health services, police, and communication systems should remain the same as identified in Alternative I. The demands for electrical power, water, and fire protection facilities should be just within the projected ranges.

Cold Bay: Cold Bay could experience moderate impacts on its community infrastructure. Impacts on housing, education, electrical power, water, sewage, solid waste disposal, health services, police, fire, and communication systems would be very similar to, if not the same as, levels identified in Alternative I.

Conclusions: St. Paul would experience decreased impacts under this alternative compared to Alternative I. The probability of an interaction between infrastructure and oil and gas development is unlikely. The probability of a significant impact, assuming there is an interaction, is unlikely. The overall probability of a significant interaction is very unlikely. This alternative is not significantly different from the proposal in its effects upon the community infrastructure of Unalaska and Cold Bay. The probabilities of interactions would be the same for Unalaska and Cold Bay as described for Alternative I.

Effect of Additional Mitigating Measures: The effectiveness of the mitigating measures would be the same as for the proposal (see Sec. IV.B.2.e.).

Cumulative Effects: Cumulative effects would remain the same as described in the proposal (see Sec. IV.B.2.e.).

Unavoidable Adverse Effects: Unavoidable adverse effects would remain the same as described in the proposal (see Sec. IV.B.2.e.).

3. Impacts on Cultural Resources: This alternative would remove an area of relatively high probability of prior human habitation (Sec. III.D.3.) and would, as a result, lessen the chance of interaction between oil exploration and development activities and marine archaeological sites. It would lessen the impact of OCS-related population increases on cultural resources of the Pribilof Islands.

Conclusion: This alternative would reduce the final significant impact probability to unlikely.

Effect of Additional Mitigating Measures: The adoption of the orientation and cultural resource mitigating measures (see Sec. II.B.1.c.) would reduce the final probability of significant impacts of this alternative from unlikely to very unlikely.

Cumulative Effects: The projects discussed in Section IV.A.7 when added to the impacts of Alternative IV, would have much the same effects as those described for the proposal. Cumulative impacts would not be lowered appreciably.

Unavoidable Adverse Effects: The accidental impacts on cultural resources mentioned for the proposal would be lessened to very unlikely.

4. Impacts on Economic Conditions:

a. Impacts on State and Regional Economies: The economic impact of proposed OCS petroleum development activities is expected to be minor in areas of Alaska other than the Aleutian Islands Census Division in which the development would occur. For that reason, this DEIS does not discuss the statewide and regional economic impacts.

b. Impacts on Local Economy (Defined as the Economy of the Aleutian Islands Census Division, with Emphasis on Selected Communities): Overall employment impacts in the Aleutian Islands Census Division resulting from the south side of the Alaska Peninsula scenario would be roughly 85 percent as great as indicated in Table IV.B.4.b.-1.

Conclusion: Refer to Section IV.B.4.b.

Effect of Additional Mitigating Measures: Refer to Section IV.B.4.b.

Cumulative Effects: Refer to Section IV.B.4.b.

Unavoidable Adverse Effects: Refer to Section IV.B.4.b.

5. Impacts on Transportation Systems: The most evident impact of this alternative would be to eliminate any transportation system impacts from the island of St. Paul and focus the discussion of impacts on Unalaska and Cold Bay.

Because infrastructure and employment requirements would be less for this alternative, marine and aircraft traffic impacts resulting from this alternative would be moderately lower than those described for the proposed action.

The decline in resources, due to a different schedule of production between Alternative IV and the proposal would only result in an approximate 8 percent reduction in tanker traffic during the peak production year. However, by the tenth year of production, tanker traffic generated by Alternative IV would equal 50 to 55 percent of that of the proposal. The elimination of two production platforms, 291 kilometers (181 mi) of truck pipeline, and 34 production wells, is estimated to result in 60 fewer monthly supply ship trips and 30 percent fewer barge arrivals during the peak years of development activity.

Peak development workforce under this alternative would be up to 19 percent less than that of the proposal (Tremont, 1981). This reduction in workforce would mirror itself in a corresponding reduction in the amount of aircraft operations expected to affect Unalaska and/or Cold Bay. Nevertheless, traffic levels would still be significantly impacted and facilities (especially at Unalaska) would need some upgrading.

Conclusion: Alternative IV would reduce impacts by a moderate amount from proposal. Perhaps a 10- to 20-percent reduction in overall impacts would occur. However, the probability that this alternative would interact with the transportation systems is very likely and the probability of significant impact, given this interaction, is very likely. The overall probability of significant impact would be considered to be very likely.

Effect of Additional Mitigating Measures: No change from the discussion written for the proposed action in Section IV.B.5.

Cumulative Effects: The cumulative effects caused by the interaction of this alternative with other proposed projects would only be moderately less than those discussed for the proposed action in Section IV.B.5.

Unavoidable Adverse Impacts: No change from the discussion written for the proposed action in Section IV.B.5.

6. Impacts on Coastal Zone Management: Deletion of blocks near the Pribilof Islands, with development of a bay on the south side of the Alaska Peninsula, would not be expected to adversely affect the potential district Coastal Management Program (CMP) for the Aleutian Islands region. Impacts, if any, to the Pribilof Islands CMP would be diluted because the nearest blocks would be 81 kilometers (50 mi) from the islands.

The Aleutian Islands and southern Alaska Peninsula area would experience the same impacts as identified in the proposal (see Sec. IV.B.6.).

Conclusion: Impacts would be the same as identified for the proposal, except that impacts to the Pribilof Islands could be diluted due to distance from the lease area.

Effect of Additional Mitigating Measures: Effective mitigation of oil and gas impacts would be the same as with the proposal (see Sec. IV.B.6.).

Cumulative Effects: Development of the small boat harbor at St. Paul Island would not be adversely impacted by this deletion. Cumulative effects would be the same as identified for the proposal (see Sec. IV.B.6.).

Unavoidable Adverse Effects: The unavoidable adverse effects would be the same as with the proposal (see Sec. IV.B.6.).

7. Impacts of Other Transportation Scenarios: The three developmental and transportation scenarios, described below, are presented in order to analyze differences in impacts. They are presented to give the decisionmaker an understanding of the expected impacts if development siting and transportation systems were to differ from those of the south side of the Alaska Peninsula.

a. Pribilof Island Scenario: This scenario which entails transportation of oil by pipeline to a terminal located on one of the Pribilof Islands would not be reasonable or viable if Alternative IV were selected. Therefore, further discussion is not warranted.

b. Makushin Bay Scenario: The following impact analyses are based on a scenario which entails transportation of oil by pipeline to a terminal located at the edge of Makushin Bay. From there, oil would be transported via Unimak Pass to unspecified locations in the contiguous U.S.

Refer to Section II of this EIS for a more detailed description of this scenario. Only differences in impacts from those assessed for a similar scenario with the proposal (Sec. IV.B.7.b.) are discussed here.

(1) Impacts on Biological Resources:

(a) Impacts on Fisheries: With a commercial harvest of pink salmon and shrimp, this bay on the island of Unalaska could have these resources adversely affected by its use as a tanker port. Primarily, this would be as a result of oilspills within the bay during critical periods in their life cycles; i.e., instream migration and spawning for pink salmon and larval developmental stages for shrimp. Makushin Bay probably also has other fish species of significant commercial and intrinsic value.

Moving oil from Makushin Bay through Unimak Pass by tanker could be a risk to the Bering Sea salmon stocks that migrate through here as both adults and smolt; thus a relatively short-term risk period annually in early summer and late fall. The migrations might be diverted by a large tanker spill persisting for some weeks.

This transportation mode would remove the potential for adverse fisheries impacts on commercial fisheries on the south side of the Alaska Peninsula.

Conclusion: The development of Makushin Bay as a terminal for transshipment of oil could have adverse impact on both the shrimp and other shellfish resources of this bay, on the seasonal spawning-rearing populations of pink salmon and additionally on the commercial interests utilizing these fisheries resources. These adverse impacts are generally characterized as pollution; and interference with both these commercial species and those seeking them, they are described in detail in Section IV.B.1.a., the proposal.

Effect of Additional Mitigating Measures: No additions to or changes in mitigation measures relative to fisheries would result from adoption of the Makushin Bay scenario.

Cumulative Effects: While cumulative effects relative to the other transportation scenarios are altered by Makushin Bay, e.g. decreased probability of oilspills, the added stress to the ecosystem of Makushin Bay, the use of Unimak Pass as a portion of the transportation route, and very likely added pipeline length, are major cumulative impacts inherent to this scenario, although tankering via Unimak Pass also applies to all but the south Alaska Peninsula scenario.

Unavoidable Adverse Effects: Unavoidable adverse impacts discussed by the proposal apply also to the Makushin Bay scenario, significantly to shrimp species and pink salmon.

(b) Impacts on Marine and Coastal Birds:

Site-Specific Impacts: Contact probabilities associated with a Makushin Bay/Unimak Pass transportation route are not significantly different from the proposal except in the vicinity of the Pribilof Islands where probability of oilspill contact with Impact Zones 21 to 24 (St. George area) and 25 to 28 (St. Paul area) is reduced from 47 to 29 percent and 14 to 5 percent respectively.

Conclusion: Probability of oilspill contact and potential interaction with birds is similar to the proposal except in the Pribilof Islands vicinity where probabilities are reduced but remain unlikely for St. George area and very unlikely for St. Paul area. Because of species' sensitivity to oil, impacts are likely to be significant, but overall significant impacts are considered unlikely for these areas.

Effect of Additional Mitigating Measures: Effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

(c) Impacts on Marine Mammals:

Site-Specific Impacts: Contact probabilities associated with a Makushin Bay-Unimak Pass transportion scenario would not significantly differ from the proposal except in the vicinity of the Pribilof Islands where probability of oilspill contact with Impact Zones 21 to 24 (St. George area) and 25 to 28 (St. Paul area) is reduced from 47 to 29 percent and 14 to 5 percent, respectively.

Conclusion: Probability of oilspill contact and potential interaction with marine mammals is similar to the proposal except in the Pribilof Islands vicinity where probabilities are reduced but remain unlikely for St. George area and very unlikely for St. Paul area. Because of fur seals' sensitivity to oil, impacts are likely to be significant, but overall, significant impacts are considered unlikely for these areas.

Effect of Additional Mitigating Measures: Effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

(d) Impacts on Endangered Species: Comparison of spill risks portrayed in Appendix E, Table N18, to spill risks associated with a similar transportation mode under the proposal (Appendix E, Table 22), again shows that relatively little reduction of spill risks to important whale habitats would be afforded by Alternative IV.

Conclusion: If selection of this alternative were followed by industrial tankering to ports on the Bering Sea side of eastern Aleutian Islands there would be little, if any reduction of direct oil spill risk (see Sec. IV.B.1.d.) to endangered whales. In fact, comparison of spill statistics shown in Appendix E, Table N18 to those for the proposal as may be associated with a pipeline to the Alaska Peninsula (Appendix E, Table 20) shows that Alternative IV and a pipeline to eastern Aleutian Islands generally pose greater threats of oil spills to important whale habitats.

Effect of Additional Mitigating Measures: See Section IV.B.1.d.

Cumulative Effects: See Section IV.B.1.d.

Unavoidable Adverse Effects: See Section IV.B.1.d.

(2) Impacts on Cultural Resources: Using a Makushin Bay terminal scenario with Alternative IV means that the risk to marine cultural resources in the blocks near the Pribilofs and the blocks near Unimak Pass would be eliminated. This scenario would produce new hazards to onshore resources in the Makushin Bay area as a result of increased oilspills and disturbance.

Conclusion: The impacts on cultural resources would be less likely than Alternative IV with the south side of the Alaska Peninsula scenario.

Effect of Additional Mitigating Measures: Same as Section IV.E.3.

Cumulative Effects: Less than Section IV.E.3.

Unavoidable Adverse Effects: Same as Section IV.E.3.

(3) Impacts on Economic Conditions:

Local Economy: OCS employment impacts in the Aleutian Islands Census Division resulting from this scenario would be roughly 85 percent as great as indicated in Table IV.B.4.b.-6.

Conclusion: See Section IV.B.4.b.

Effects of Additional Mitigating Measures: See Section IV.B.4.b.

Cumulative Effects: See Section IV.B.4.b.

Unavoidable Adverse Effects: See Section IV.B.4.b.

(4) Impacts on Transportation Systems: The establishment of a tanker loading facility at Makushin Bay would have impacts on the marine transportation systems of the area similar to those hypothesized for the proposed action, except that there would be tanker traffic through Unimak Pass. In regard to air systems, it is unlikely that an air support facility of any type would be constructed on St. Paul Island. Impacts would accrue principally to the Cold Bay airfield and secondarily to the airfield at Unalaska/Dutch Harbor. Overall impacts expected for both air facilities would likely be similar to those described in Section IV.B.5. However, overall enplanements and volumes of air traffic could be expected to decline by about 20 percent from those described for the south Alaska Peninsula transportation scenario.

Conclusion: Impacts on transportation systems would be similar though moderately reduced compared to those described in Section IV.E.5.

Effect of Additional Mitigating Measures: See discussion in Section IV.E.5.

Cumulative Effects: See Section IV.E.5.

Unavoidable Adverse Effects: See Section IV.E.5.

c. Offshore Scenario: The following impact analyses are based on a scenario which entails processing and loading of oil and gas offshore. Refer to Section II for a more detailed discussion of this scenario. Only differences in impacts from those assessed for a similar scenario with the proposal (Sec. IV.B.7.c.) are discussed here.

(1) Impacts on Biological Resources:

(a) Impacts on Marine and Coastal Birds:

Site-Specific Impacts: Contact probabilities associated with an offshore loading Unimak Pass transportation route are not significantly different from the proposal except in the vicinity of the Pribilof Islands where probability of oilspill contact with Impact Zones 21 to 24 (St. George area) and 25 to 28 (St. Paul area) is reduced from 58 to 38 percent and 19 to 5 percent respectively.

Conclusion: Probability of oilspill contact and potential interaction with birds is similar to the proposal except in the Pribilof Islands vicinity where probabilities are reduced to unlikely and very unlikely. Because of species' sensitivity to oil, impacts are likely to be significant. Probability of significant impacts are considered unlikely for the two island areas.

Effect of Additional Mitigating Measures: Effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

b. Impacts on Marine Mammals:

Site-Specific Impacts: Contact probabilities associated with an offshore loading-Unimak Pass transportation scenario are not significantly different from the proposal except in the vicinity of the Pribilof Islands. There, probability of oilspill contact with Impact Zones 21 to 24 (St. George area) and 25 to 28 (St. Paul area) is reduced from 58 to 38 percent and 19 to 5 percent, respectively.

Conclusion: Probability of oilspill contact and potential interaction with marine mammals is similar to the proposal except in the Pribilof Islands vicinity where probabilities are reduced to unlikely and very unlikely. Because of fur seals' sensitivity to oil, impacts are likely to be significant, but overall, significant impacts are considered unlikely for the two island areas.

Effect of Additional Mitigating Measures: Effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

c. Impacts on Endangered Species: As also concluded for a potential pipeline to an eastern Aleutian Island (Sec. IV.E.7.b.), if election of Alternative IV were followed by offshore loading, risks of direct oilspill effects on endangered whales would not differ significantly from those expected under the proposal (as may be associated with offshore loading). Comparison of statistics in Appendix E, Table N19 to those of Appendix E, Table 31 support this conclusion. Comparison of Appendix E, Table 20 shows that spill risks to certain whale habitats due to offshore loading associated with Alternative IV would exceed those to be incurred under the proposal if such leasing were supported by a pipeline toward a terminus on the south side of the Alaska Peninsula.

Conclusion: If selection of Alternative IV were followed by offshore loading, risks of direct oilspill effects on endangered whales would not differ significantly from those presented under the proposal.

Effect of Additional Mitigating Measures: See Section IV.B.1.d.

Cumulative Effects: See Section IV.B.1.d.

Unavoidable Adverse Effects: See Section IV.B.1.d.

(2) Impacts on Cultural Resources: Using offshore loading and tankering with Alternative IV would reduce the pipeline risk to marine cultural resources in both the sensitive blocks near the Pribilof Islands and the coastal resources of the Makushin Bay area. The resources along coastlines, especially Unimak Pass, would be more likely to interact with oil as a result of tanker accidents. This risk is higher than that indicated in Section IV.E.3.

Conclusion: Impacts on cultural resources would be greater than those described in Section IV.E.3. The probability of significant impact would remain unlikely.

Effect of Additional Mitigating Measures: Same as Section IV.E.3.

Cumulative Effects: Same as Section IV.E.3.

Unavoidable Adverse Effects: Same as Section IV.E.3.

(3) Impacts on Economic Conditions: OCS employment impacts in the Aleutian Islands Census Division resulting from this scenario would be roughly 85 percent as great as indicated in Table IV.B.4.b.-7.

Conclusion: See Section IV.B.4.b.

Effect of Additional Mitigating Measures: See Section IV.B.4.b.

Cumulative Effects: See Section IV.B.4.b.

Unavoidable Adverse Effects: See Section IV.B.4.b.

(4) Impacts on Coastal Zone Management: Deletion of blocks near the Pribilof Islands, with development of offshore loading and tankering, are not expected to adversely affect the CMP in the Aleutian/ Pribilof Islands region. With offshore loading and tankering there is less likelihood of impacts occurring within the district CMP boundaries.

Conclusion: Development of offshore loading and tankering would create less impacts to the district CMPs than those impacts experienced if a bay on the south side of the Alaska Peninsula were developed.

Effect of Additional Mitigating Measures: The mitigating measures suggested as effective for development of a terminal on the south side of the Alaska Peninsula under Alternative IV would also be effective for development of offshore loading and tankering, assuming those acitivies were within the boundaries of the CMP's.

Cumulative Effects: Cumulative effects upon the district CMP in the Aleutian/ Pribilof Islands area under Alternative IV would be the same as those experienced if a terminal on the south side of the Alaska Peninsula were developed.

Unavoidable Adverse Effects: The development of offshore loading and tankering may create the same unavoidable adverse effects as those experienced with development of a terminal on the south side of the Alaska Peninsula under Alternative IV.

F. Alternative V - Deletion near Unimak Pass

Modification of the proposal by the deletion of 135 blocks located near Unimak Pass. Refer to Section II.B.5. for a complete description of this alternative.

1. Impacts on Biological Resources:

a. Impacts on Fisheries: Walleye pollock eggs/larvae and larval tanner crab are seasonally widely distributed through the pelagic zone of the waters encompassed by this deletion; if this alternative were to be implemented impacts on these species would be reduced compared to those described in Section IV.B.1.a. Pollock eggs/larvae have a 93-percent chance of being contacted by an oilspill within 3 days after its occurrence, while this is reduced to 56 - 59 percent should this alternative be adopted. This represents a significant reduction in risk to these species; however, these probabilities represent contact with a small part of the egg/larvae population, which is widely distributed over much of the eastern Bering Sea. The species are also only present for about 6 months annually and, while pelagic, are at depths of 13 to 300 meters (43-984 ft). While the larval pollock may be near-surface under varying light and wind conditions, the overall risk is assessed as low, and contact with an oilspill, unlikely.

Other species of demersal fish, Pacific halibut, yellowfin sole, sablefish, Pacific cod, etc., would not be affected by this alternative.

The planktonic larval tanner crab are also seasonally present within the area included in this alternative; their vulnerability to an oilspill is similar to that for the walleye pollock eggs/larvae save that the larval organisms are only at or near the surface for a few days after hatching. The probability oil would contact larval tanner crab is unlikely. King crab would not be affected by this alternative.

It is probable that Pacific herring, adult and immature, seasonally migrate through the area deleted by this alternative. Aside from avoidance of an oilspill area and temporarily reduced food supply, no adverse impacts are foreseen for this species.

Adult salmon of all five Pacific species migrate through portions of the area included in this alternative. No impacts to these anadromous fish are foreseen should this alternative be selected. Even a large oilspill could readily be avoided by salmon traversing this vast area.

Conclusion: While some reduction in risk to walleye pollock eggs/larvae would result if these blocks were deleted, overall probability for adverse impacts on demersal finfish, pelagic finfish, and shellfish is low. This alternative differs from the proposal only in the reduced risk to walleye pollock. The probability of significant impacts from oilspills is very unlikely.

Effect of Additional Mitigating Measures: The effectiveness of mitigating measures for this alternative does not differ from that of the proposal.

Cumulative Effects: Reduced oil and gas exploration and development in the area of these deleted blocks would cumulatively affect fisheries resources only in that potential adverse effects through oilspills would be reduced. Other cumulative effects, as discussed for the proposal, would remain the same.

Unavoidable Adverse Impacts: The unavoidable adverse impacts related to this alternative would not differ from those discussed by the proposal.

Impacts on Commercial Fishing: While some commercial fishing for tanner crab occurs in the area considered for deletion, the majority of American vessels fish further westward. Foreign trawlers also, concentrate their bottomfishing efforts more to the west. Some reduction in gear loss, reduced probability of vessel collisions, and reduced risk of oil polluting crab catches are benefits to the commercial fishery derived from this alternative. The commercial fishery would also receive minor benefit through protection of fisheries resources via reduced oil pollution.

Salmon and herring fishermen would not benefit by this deletion, nor would king crab fishermen.

Conclusion: The commercial fisheries for tanner crab and bottomfish would benefit from this deletion, via a reduction in conflicts between these fisheries and the oil industry. Given the variability in fishing effort, seasonal variability, catch quotas, fishing boundaries, etc., it is not possible to ascertain the reduction in these conflicts.

Effect of Additional Mitigating Measures: These would be the same as the proposal.

Cumulative Effects: It is unlikely that commercial fishing fleet efforts will expand and in the area proposed for deletion. Interference with some halibut fishing would be reduced.

Unavoidable Adverse Effects: Under certain sets of conditions, oilspills occurring in the area included in this alternative could reach nursery areas for king crab; this deletion would not significantly reduce already low oilspill risk to king crab nursery areas compared to the proposal.

b. Impacts on Marine and Coastal Birds: The principal effect of deleting southeastern blocks would be to reduce the probability of oilspill interaction with birds foraging or migrating in a broad zone surrounding the west entrance to Unimak Pass and in offshore areas northeast of the pass. Spills from hypothetical points within this deletion (P16-P18, P20) contact the vicinity of Unimak Pass (Impact Zones 5-8, 9-10) and northeast of this area (Impact Zones 11-12) with average probabilities of 31, 6, and 23 percent. With these blocks removed, spill contact probabilities from hypothetical spill points now nearest Unimak Pass and northeast areas (P13-P15) average 21, 2, and 1 percent, a substantial reduction in risk to the pass and lagoon areas. Elsewhere in the proposed sale area there is little difference in probability of interactions. Disturbance from increased air traffic and human presence associated with oil and gas activities could have severe impacts on production by colonial species during the nesting season, adding to any effects on the populations caused by contact with oil at sea.

Site-Specific Impacts: Oilspill contact probabilities associated with an Alaska Peninsula transportation scenario are not significantly different from the proposal except beyond Unimak Pass west entrance (Impact Zones 5-8), northeast of this area (Impact Zones 11), and central offshore areas (Impact Zones 14-17), where probability of oilspill contact is reduced from 72 to 14 precent, 52 to 8 percent, and 88 to 64 percent, respectively, with this deletion.

Conclusion: With this deletion, probability of oilspill contact and potential interaction with birds is similar to the proposal except in important foraging areas in the vicinity of Unimak Pass and Izembek Lagoon where it is reduced from likely to very unlikely. Probability of contact with central offshore areas is reduced from very likely to likely. Because of sensitivity to oil, impacts on most species would likely be significant if an interaction occurred, but regionally significant impacts between seabirds and oilspills are considered unlikely in these areas.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

c. Impacts on Marine Mammals: The principal effect of deleting southeastern blocks would be to reduce the probability of oilspill interaction with marine mammals foraging or migrating in a broad zone surrounding the west entrance to Unimak Pass and in offshore areas northeast of the pass. Spills from hypothetical points within this deletion (P16-P18, P20) contact the vicinity of Unimak Pass (Impact Zones 11-12) with average probabilities of 31, 6, and 23 percent. With these blocks removed, spill contact probabilities from hypothetical spill points now nearest Unimak Pass and northeast areas (P13-P15) average 21, 2, and 1 percent, a substantial reduction in risk to the pass and lagoon areas. Elsewhere in the proposed sale area there is little difference in probability of interactions. Disturbance from transportation activity and human presence also would decrease with this alternative. Potential disturbance and habitat degradation associated with construction of proposed projects on St. Paul and Unalaska Islands probably would not decrease with this alternative.

Site-Specific Impacts: With this deletion, oilspill contact probabilities associated with an Alaska Peninsula transportation scenario are not significantly different from the proposal except beyond Unimak Pass west entrance (Impact Zones 5-8), northeast of this area (Impact Zones 11-12), and central pelagic areas (Impact Zones 14-17), where probability of oilspill contact is reduced from 72 to 14 precent, 52 to 8 percent and 88 to 64 percent, respectively.

Conclusion: With this deletion, probability of oilspill contact and potential interaction with marine mammals is similar to the proposal except in important foraging, migration, and breeding areas in the vicinity of Unimak Pass and Izembek Lagoon where it is reduced from likely to very unlikely. Probability of contact with central offshore areas is reduced from very likely to likely. Because of sensitivity to oil, impacts on most species would likely be significant if an interaction occurred, but regionally significant impacts between marine mammals and oilspills are considered unlikely in these areas.

Effect of Additional Mitigating Measures: Effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

d. Impacts on Endangered Species and Non-Endangered Cetaceans: See Section IV.B.1.d for a general discussion of the potential direct and indirect effects upon endangered species and non-endangered cetaceans. (Unless otherwise specified, oil spill risk analyses made in this section refer to probabilities conditional on the development of a production field as described in Secs. II.A. and IV.A., and to associated 10-day, 1,000 bbl spill contact rates portrayed in Appendix E.) Appendix E, Table 7 shows that this alternative would eliminate potential spill source points (e.g. source points P16, P17, P20) which will entail up to a 56 percent conditional chance (hypothetical target 7) that spills would move toward or possibily occur in important migratory corridors of endangered species frequenting the Unimak Pass region. Of source points simulated in the blocks which would be deleted under this alternative, spill point 20 (in the southern most discrete area of contiguous blocks) has a conditional probability of 56 percent chance that spills originating therein would move toward offshore areas north of Unimak Pass and a 17 percent conditional probability of moving toward nearshore environments of the northern Unimak Island (Appendix E, Table 7, hypothetical targets 7 and 10, respectively). Other potential spill sources, such as P9-P15, located on more western blocks than those represented by P16, P17, or 20 generally pose less conditional risk to those areas. Thus, deletion of those blocks would eliminate blocks which pose a moderate to very high risk to an important endangered species migratory corridor if spills would occur thereon.

Assuming development and petroleum resource potential as described previously, and assuming oil would be piped toward the Alaska Peninsula prior to tanker loading (transportation scenario A), risk under this alternative would be substantially less than would be incurred under similar transportation modes for the proposal. Appendix E, Table N20 shows that risks to the Unimak Pass region (hypothetical targets 5-8) would be 0 to 8 percent as opposed to 7 to 41 percent which would be incurred under the proposal. Similarly, Unimak Pass and northern Unimak Island offshore areas (hypothetical targets 9-10) would be under 0 to 2 percent risk as compared to as much as 16 percent under the proposal. Risk to offshore areas represented by hypothetical targets 14-17 would be reduced 15 to 21 percent under this alternative as opposed to the proposal.

This alternative probably would not provide a substantial reduction in potential effects of noise and disturbance on endangered species and non-endangered cetaceans as compared to that described under the proposal. However, localized effects on species known for their offshore preference such as fin, sperm, or some humpback whales would be reduced in blocks which would be deleted under this alternative.

Conclusion: It is likely that oil spills would interact with endangered species and non-endangered cetaceans/or their habitat under this alternative. It is unlikely that such an interaction, if it occurred, would have significant direct or indirect impact on endangered whale populations. Therefore, it is very unlikely that a significant effect due to oilspills would occur for endangered whales or non-endangered cetaceans as a result of this alternative. Potential effects which may be associated with noise and disturbance would not be reduced significantly under this alternative although localized reductions may be afforded.

Effect of Additional Mitigating Measures: Analyses of effective mitigating measures would be essentially the same as discussed with the proposal (Sec. IV.B.1.d.).

Cumulative Effects: Analyses of cumulative effects on endangered species or non-endangered cetaceans would be essentially the same as discussed for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects incurred under this alternative would be essentially the same as those discussed under the proposal.

2. Impacts on Social Systems:

a. Impacts on Population: Total OCS-induced population contributed by Alternative V would be approximately half the amount produced by the proposal. Distribution of this population under the south peninsula terminal scenario coincides proportionately with the proposal, although local effects in some cases are consistent with the proposal. OCS-related population effects in St. Paul essentially are nil, as in the proposal, representing less than 1 percent of total population over the life of the field. In Unalaska, the population effects of OCS activities remain marginal to the population effects of bottomfishing industry development, with Alternative V under this scenario contributing 8 percent of total population (264 of 3,209) in 1985, compared with 15 percent under the proposal, and approximately half the long-term population effects (1-2% of total population) of the proposal. OCS-induced population would account for 24 percent of total population (105 of 437) in Cold Bay in 1985, compared with 39 percent under the proposal. Thereafter, 30 to 40 percent of total population is attributed to OCS activities through 2000, compared with 45 to 56 percent of total population under the proposal. Although numerically half the population attributed to the proposal, the population contributed by OCS operations as a proportion of total population in Cold Bay remains as a substantial component. In comparison with the proposal, Alternative V under this scenario represents only 15 percent less of total population in Cold Bay during the initial period (1985) and over the long-term life of the field.

Conclusion: Impacts on population would be the same as the proposal (see Sec. IV.B.2.a.).

Effect of Additional Mitigating Measures: Same as the proposal.

Cumulative Effects: Same as the proposal.

Unavoidable Adverse Effects: Same as the proposal.

b. Impacts on Subsistence: Impacts on subsistence are considered in terms of potential effects from population concentrations and oil pollution incidents. The amount, characteristics, and distribution of population for Alternative V are as discussed in Section IV.B.2.a. The results of the Oilspill Risk Analysis for this alternative, using the south peninsula terminal scenario, are the same as the proposal for the Pribilof Islands and subtantially the same elsewhere in comparison with the proposal. Risks from oilspill incidents to the subsistence ranges of False Pass and Nelson Lagoon are reduced from a medium to low probability of interaction within 30 days of a spill. Absence of risk is present within the 3- and 10-day periods, as in the proposal.

Conclusion: Impacts on subsistence are the same as the proposal (Sec. IV.B.2.b.).

Effect of Additional Mitigating Measures: Same as the proposal.

Cumulative Effects: Same as the proposal.

Unavoidable Adverse Effects: Same as the proposal.

c. Impacts on Fishing Village Livelihood: Impacts on fishing village livelihood are considered in terms of potential effects from oil pollution incidents. The results of the Oilspill Risk Analysis for this alternative, using the south peninsula terminal scenario, are substantially the same as in the proposal, showing a comparable pattern but reduction of risk. Reductions consistently take place in the 30-day period of risk for the fishing grounds near False Pass and Nelson Lagoon. The absence of risk within the critical 3- and 10-day periods following a spill is the same as the proposal.

Conclusion: Impacts on fishing village livelihood are the same as the proposal (Sec. IV.B.2.c.).

Effect of Additional Mitigating Measures: Same as the proposal.

Cumulative Effects: Same as the proposal.

Unavoidable Adverse Effects: Same as the proposal.

d. Impacts on Sociocultural Systems: Impacts on sociocultural systems are contextual questions surrounding impacts potentially contributed by population concentrations and oil pollution incidents. Based on the south peninsula terminal scenario, potential effects from population and oilspill incidents for Alternative V are substantially the same as in the proposal (Sec. IV.B.2.d.).

Conclusion: Impacts on sociocultural systems are the same as the proposal.

Cumulative Effects: Same as the proposal.

Effect of Additional Mitigating Measures: Same as the proposal.

Unavoidable Adverse Effects: Same as the proposal.

e. Impacts on Community Infrastructure: This alternative, which deletes blocks near Unimak Pass, may decrease impacts to St. Paul, Unalaska, and Cold Bay from those identified in Alternative I assuming a pipeline, terminal, and tankering operation is located at a bay on the south side of the Alaska Peninsula for both alternatives. Due to the lower projected values for resources under this alternative, levels of impacts may be decreased by half for all three communities.

St. Paul: The demand for housing could peak at two units. The demand for educational facilities could be minimal, as there may be only one or two additional students. The demand for electrical power could peak at 32 kilowatts. Water consumption demands could peak at 1,467,482 liters (387,812 gals) annually. The sewage system demand could peak at 503 liters (132.5 gals) per day. The demand for solid waste could peak at 168,646.5 kilograms (16,598 lbs) annually. Health care service demands could peak at one additional physician, and three acute-care beds. One additional police officer could be required. A new fire station could be required. The communication facility demand could peak at three additional lines.

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Unalaska: The demand for housing could peak at 65 units. The educational facility demand could peak at one additional classroom every two to three years. The electrical power demand could peak at 712 kilowatts. Water consumption demands could peak at 32,800,000 liters (8,659,200 gals) annually. The sewage system demand could peak at 11,241 liters (2969 gals) per day. The solid waste disposal demand could peak at 168,646 kilograms (371,022 lbs) annually. Health care service demands could peak at one additional physician and three acute-care beds. Demand for police officers could peak at four officers. A new fire station could still be required. The demand for communication lines could peak at 72 lines.

Cold Bay: The demand for services in Cold Bay could be a total of 50 to 65 percent lower than the values identified in Alternative I due to the deletion of a high number of blocks near Unimak Pass, thus making Cold Bay a less likely place for development. The housing demand could peak at 66 units. The educational facility demand could peak at two additional classrooms. The demand for electrical power could peak at 1275 kilowatts. Water consumption demand could peak at 4,260,016 liters (1,124,644 gals) annually. The sewage system demand could peak at 6254 liters (1,652 gals) per day. The solid waste disposal demand could peak at 218,559 kilograms (480,830 lbs) per day. Health care service demands could peak at one additional physician and three acute-care beds. One additional police officer could be required. The fire protection systems could receive less demand. Communication facility demands could peak at 38 additional lines.

Conclusion: St. Paul and Unalaska would seem to experience substantially decreased impacts under this Alternative, compared to Alternative I. The probabilities of interaction would remain the same for St. Paul and Unalaska as described in Alternative I. Cold Bay could experience decreased impacts, perhaps even somewhat lower than St. Paul and Unalaska, under this alternative compared to Alternative I. The probability of an interaction between infrastructure and oil and gas development is unlikely. The probability of a significant impact, assuming there is an interaction is very unlikely. The overall probability of a significant interaction is very unlikely.

Effect of Additional Mitigating Measures: The effectiveness of the mitigating measures would be the same as for the proposal (see Sec. IV.B.2.e.).

Cumulative Effects: Cumulative effects would remain the same as described for the proposal (see Sec. IV.B.2.e.).

Unavoidable Adverse Effects: Unavoidable adverse effects would remain the same as described for the proposal (see Sec. IV.B.2.e.).

3. Impacts on Cultural Resources: Deletion of blocks near Unimak Pass would result in reduced impact on historic shipwrecks (see Sec. III.D.) which might be in that area by reducing the number of adverse interactions. The blocks in this area are of low probability of prior human habitation so that deletion of these blocks would not appreciably lower the number of interactions to marine cultural resources. Adverse interactions would be lessened for onshore cultural resources on Federal and other lands especially in the Cold Bay area, because of the reduction of OCS employment-related population impacts (see Sec. IV.E.4.).

Conclusion: This alternative would lower the probability of significant impacts from likely to unlikely.

Effect of Additional Mitigating Measures: The adoption of the orientation and cultural resource mitigating measures (see Sec. II.B.1.c.) would reduce the final probability of significant impacts of this alternative from unlikely to very unlikely.

Cumulative Effects: The impacts of the projects discussed in Section IV.A.7. when added to the impacts of Alternative V, would have much the same effects as the cumulative impacts described for the proposal. Cumulative impacts with Alternative V would occur in Unimak Pass but any interaction with activities on blocks near Unimak Pass would not be present. As a result, impacts would be reduced slightly.

Unavoidable Adverse Effects: The accidental impacts on cultural resources mentioned for the proposal would be lessened to very unlikely.

4. Impacts on Economic Conditions:

a. Impacts on State and Regional Economies: The economic impact of proposed OCS petroleum development activities is expected to be minor in areas of Alaska other than the Aleutian Islands Census Division in which the development would occur. For that reason, this DEIS does not discuss the statewide and regional economic impacts.

b. Impacts on Local Economy (Defined as the Economy of the Aleutian Islands Census Division, with Emphasis on Selected Communities): Overall employment impacts in the Aleutian Islands Census Division resulting from the south side of the Alaska Peninsula scenario would be roughly 55 percent as great as indicated in Table IV.B.4.b.-1.

Conclusion: Refer to Section IV.B.4.b.

Effect of Mitigating Measures: Refer to Section IV.B.4.b.

Cumulative Effects: Refer to Section IV.B.4.b.

Unavoidable Adverse Effects: Refer to Section IV.B.4.b.

5. Impacts on Transportation Systems: Transportation system impacts resulting from this alternative are substantially lower than those forecast for the proposed action. The reduction in production wells, pipeline lengths, manpower and resources with this alternative would result in the following impact differences from the proposed action: up to 40 percent reduction in overall barge traffic (as listed in Table IV.C.5.-2), a 25-percent reduction in workforce and commuter air traffic requirements, and a 30- to 35-percent reduction in tanker traffic throughout the life of the field.

Conclusion: This alternative would substantially reduce barge traffic entering Unalaska, commuter air traffic serviced by the affected air fields, and total volumes of tanker traffic as compared to the proposal. Overall impacts resulting from this proposal should be 25 to 30 percent less than that of the proposal. However, there is a very likely probability that the transportation systems of the area would be impacted, the impact would be significant, and the overall impact of this alternative would likely be significant.

Effect of Additional Mitigating Measures: See discussion in Section IV.B.5.

Cumulative Effects: See discussion in Section IV.B.5.

Unavoidable Adverse Impacts: See Section IV.B.5.

6. Impacts on Coastal Zone Management: Deletion of blocks near Unimak Pass, with development of a terminal on the south side of the Alaska Peninsula, would not be expected to adversely affect the potential district Coastal Management Programs (CMP) for the Aleutian/ Pribilof Islands region. Impacts, if any, to the CMP for the Aleutian Islands northeast of Unimak Pass would be diluted due to the greater distance from the proposed sale area.

The remainder of the Aleutian Islands and the Pribilof Islands would experience impacts the same as with the proposal (see Sec. IV.B.6.).

Conclusion: Impacts would be substantially the same as with the proposal except that those islands nearest to the deleted blocks would be less affected.

Effect of Additional Mitigating Measures: Effective mitigation of oil and gas impacts under this alternative would be the same as with the proposal (see Sec. IV.B.6.).

Cumulative Effects: Cumulative effects would be the same as identified for the proposal (see Sec. IV.B.6.).

Unavoidable Adverse Effects: The unavoidable adverse effects would be the same as with the proposal (see Sec. IV.B.6.).

7. Impacts of Other Transportation Scenarios: The three developmental and transportation scenarios, described below, are presented in order to analyze differences in impacts. These are presented to give the decisionmaker an understanding of the expected impacts if development siting and transportation systems were to differ from those of the south side of the Alaska Peninsula scenario.

a. Pribilof Island Scenario: The following impact analyses are based on a scenario which entails transportation of oil by pipeline to a terminal located on one of the Pribilof Islands (most reasonably St. Paul). From there, oil would be transported by tanker via Unimak Pass to an unspecified location in the contiguous U.S. Refer to Section II of this EIS for a more detailed description of this scenario. Only differences in impacts from those assessed for a similar scenario with the proposal (Sec. IV.B.7.a.) are discussed here.

(1) Impacts on Biological Resources:

(a) Impacts on Marine and Coastal Birds:

Site-Specific Impacts: With this alternative, oilspill contact probabilities associated with a St. Paul/Unimak Pass transportation route are not significantly different from the proposal except in the vicinity of Unimak Pass (Impact Zones 5-8, 9-10), offshore areas northeast and northwest of the pass (Impact Zones 11-12, 14-17), and at shelfbreak (Impact Zones 19-20), where chance of spill contact is reduced from 84 to 41 percent, 42 to 20 percent, 34 to 1 percent, 87 to 59 percent, and 50 to 33 percent, respectively.

Conclusion: Probability of oilspill contact and potential interaction with birds is similar to the proposal except in a broad area surrounding western Unimak Pass, northeastward from the pass and towards shelfbreak, where average chance of interaction is reduced from likely to unlikely. Because of sensitivity to oil, impacts on most species are likely to be significant, but regionally significant impacts are considered unlikely in these areas.

Effect of Additional Mitigating Measures: The effect of mitigating measures is the same as for the proposal.

Cumulative Effects: Cumulative effects are the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects are the same as for the proposal.

(b) Impacts on Marine Mammals:

Site-Specific Impacts: With this alternative, oilspill contact probabilities associated with a St. Paul-Unimak Pass transportation scenario are not significantly different from the proposal except in the vicinity of Unimak Pass (Impact Zones 5-8, 9-10), offshore areas northeast and northwest of the pass (Impact Zones 11-12, 14-17), and at shelfbreak (Impact Zones 19-20). In these locations, chance of spill contact is reduced from 84 to 41 percent, 42 to 20 percent, 34 to 1 percent, 87 to 59 percent, and 50 to 33 percent, respectively.

Conclusion: Probability of oilspill contact and potential interaction with marine mammals is similar to the proposal except in a broad area surrounding western Unimak Pass, northeastward from the pass and towards shelfbreak, where average chance of interaction is reduced from likely to unlikely. Because of sensitivity to oil, impacts on most species are likely to be significant, but regionally significant impacts are considered unlikely in these areas.

Effect of Additional Mitigating Measures: Effects of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

(c) Impacts on Endangered Species: If oil were piped toward the Pribilof Islands under this alternative, substantial reduction of oilspill risk to the Unimak Pass region would be afforded as compared to similar transportation for the proposal. Risk to the outer Unimak Pass region (hypothetical target 5-8) would be 6 to 21 percent (Appendix E, Table 25) as compared to 15 to 56 percent (Appendix E, Table 21) under the proposal and similar transportation. Risk to the inner pass region (hypothetical targets 9-10) would be 7 to 14 percent (Appendix E, Table 25) as compared to 23 to 24 percent under the proposal. However, such risk levels are higher than would be incurred under Alternative V if oil were piped toward the Alaska Peninsula (Appendix E, Table N20).

Also, as may be expected, risk to offshore area surrounding the Pribilof Islands are relatively high under pipeline transportation to the islands for this alternative. Appendix E, Table 25 shows hypothetical targets 22 to 24 (near St. George Island) and hypothetical targets 26 to 27 (near St. Paul Island) at 18 to 47 percent and 24 to 27 percent, respectively. These are about 10 percent lower than would be incurred for the same transportation scenario under the proposal (Appendix E, Table 21) but as much as 19 percent more than would be incurred by the proposal if oil were transported by pipeline to a terminus on the south side of the Alaska Peninsula (Appendix E, Table 20).

Conclusion: Risk of significant effects of oilspills on endangered whales and non-endangered cetaceans would be greater than described in the conclusion to Section IV.F.1.d.

Effect of Additional Mitigating Measures: See Section IV.B.1.d.

Cumulative Effects: See Section IV.B.1.d.

Unavoidable Adverse Effects: See Section IV.B.1.d.

(2) Impacts on Social Systems:

(a) Impacts on Population: Total OCS-induced population contributed by Alternative V would be approximately half the amount produced by the proposal. Distribution of this population under the Pribilof Islands terminal scenario coincides proportionately with the proposal. OCS-related population effects remain marginal to the population effects of bottomfishing industry development in Unalaska under the Pribilof Islands terminal scenario, with Alternative V contributing 6 percent of total population (184 of 3,129) in 1985, compared with 11 percent under the proposal, and approximately the same long-term population effects (less than 1% of total population) as the proposal. In Cold Bay, the Pribilof Islands terminal scenario contributes 14 percent of total population (55 of 387) in 1985, compared with 25 percent under the proposal.

As in the proposal, the largest population effect from the scenario occurs on the Pribilof Islands. Using St. Paul for example, OCS-related population accounts for 16 percent of total population (98 of 623) in the 1985 period prior to the inception of bottomfishing activities. As a proportion of total population thereafter, OCS-related population accounts for 12 to 22 percent of total population when bottomfishing is included. If bottomfishing population on the island were enclaved to mitigate interaction with the resident Aleut population, OCS population would comprise 27 to 44 percent of total population over the life of the field.

Conclusion: The potential for population interaction is the same as the proposal under the Pribilof Islands terminal scenario. The probability of significant impact should interaction occur, defined as an added 30 percent component of total population at any point in time, is likely on the Pribilof Islands and unlikely in Unalaska and Cold Bay. The probability of significant population impacts is likely on the Pribilof Islands and unlikely in Unalaska and Cold Bay.

Effect of Additional Mitigating Measures: See Section IV.B.7.a.

Cumulative Effects: See Section IV.B.7.a.

Unavoidable Adverse Effects: See Section IV.B.7.a.

(b) Impacts on Subsistence: Impacts on subsistence are considered in terms of potential effects from population concentrations and oil pollution incidents. The amount, characteristics, and distribution of population for Alternative V are as discussed in Section IV.F.7.a. The results of the Oilspill Risk Analysis for this alternative, using the Pribilof Islands terminal scenario, are substantially the same as the proposal, with the exception of the Pribilof Islands and the villages east of Unimak Pass. Although the 10- and 30-day risk probabilities are the same as the proposal for the Pribilof Islands, the critical 3-day risk is eliminated under this scenario. East of Unimak Pass, the 30-day risk to the Nelson Lagoon subsistence range is eliminated and the risk for the same time period is reduced from a medium to low probability for the subsistence range of False Pass.

Conclusion: Impacts on subsistence are the same as the proposal for the Pribilof Islands terminal scenario, with the exception of reducing the probability of significant impacts to the Pribilof Islands from very likely to likely over the life of the field.

Effect of Additional Mitigating Measures: See Section IV.B.7.a.

Cumulative Effects: See Section IV.B.7.a.

Unavoidable Adverse Effects: See Section IV.B.7.a.

(c) Impacts on Fishing Village Livelihood: Impacts on fishing village livelihood are considered in terms of potential effects from oil pollution incidents. The results of the Oilspill Risk Analysis for this alternative, using the Pribilof Islands terminal scenario, are substantially the same as in the proposal, showing a comparable pattern but reduction of risk. Reductions consistently take place in the 30-day period of risk for the fishing grounds near False Pass and Nelson Lagoon. The absence of risk within the critical 3- and 10-day periods following a spill is the same as the proposal.

Conclusion: Impacts on fishing village livelihood are the same as the proposal with the Pribilof Islands terminal scenario (Sec. IV.B.7.a.).

Effect of Additional Mitigating Measures: See Section IV.B.7.a.

Cumulative Effects: See Section IV.B.7.a.

Unavoidable Adverse Effects: See Section IV.B.7.a.

(d) Impacts on Sociocultural Systems: Based on the Pribilof Islands terminal scenario, potential effects from population and oilspill incidents for Alternative V are substantially the same as in the proposal for Unalaska and the Pribilof Islands. With a reduced probability of significant population impact to Cold Bay, the potential for effects to the sociocultural systems of Cold Bay is similarly reduced.

Conclusion: Impacts on sociocultural systems are the same as the proposal with the Pribilof Islands terminal scenario (Sec. IV.B.7.a.) in Unalaska and on the Pribilof Islands. The probability of significant impacts to the sociocultural systems of Cold Bay is reduced from likely to unlikely over the life of the field.

Effect of Additional Mitigating Measures: See Section IV.B.7.a.

Cumulative Effects: See Section IV.B.7.a.

Unavoidable Adverse Effects: See Section IV.B.7.a.

(e) Impacts on Community Infrastructure: St. Paul could experience levels of demand for housing, utilities, education, and so forth that are the same level, and perhaps 5 to 10 percent higher due to development of a terminal on St. Paul, than the levels identified with development of a terminal on the south side of the Alaska Peninsula (Sec. IV.F.2.c.).

Unalaska and Cold Bay would seem to experience levels of demand for housing, utilities, education and so forth the same as the levels identified with development of a terminal on the south side of the Alaska Peninsula.

Conclusion: All three communities would seem to be able to adequately support the change in demand under this scenario compared to development of a terminal on the south side of the Alaska Peninsula.

Effect of Additional Mitigating Measures: The effectiveness of the mitigating measures would be the same as for development of a terminal on the south side of the Alaska Peninsula (Sec. IV.F.2.e.).

Cumulative Effects: Cumulative effects would remain the same as with development of a terminal on the south side of the Alaska Peninsula.

Unavoidable Adverse Effects: Unavoidable adverse effects would remain the same as identified with development of a terminal on the south side of the Alaska Peninsula.

(3) Impacts on Cultural Resources: There would be more hazards to marine resources in the Pribilof Island area with this alternative since there would be pipelines traversing blocks of high prior human habitation probabilities near the Pribilof Islands. In general, interactions with cultural resources would be higher with this scenario than with a south side Alaska Peninsula scenario.

Conclusion: Impacts on marine cultural resources are more likely to occur with this scenario.

Effect of Additional Mitigating Measures: Same as Section IV.F.3.

Cumulative Effects: Same as Section IV.F.3.

Unavoidable Adverse Effects: Same as Section IV.F.3.

(4) Impacts on Economic Conditions: Overall employment impacts in the Aleutian Islands Census Division resulting from this scenario would be roughly 55 percent as great as indicated in Table IV.B.4.b.-5.

Conclusion: Conclusions are the same as presented in Section IV.B.4.b., except that this scenario would create much larger numbers of additional jobs at St. Paul, where only 20 percent of the residents are currently employed. Although the forecasted expansion of bottomfish harvesting and processing may provide jobs for all Pribilof Islanders who desire to work, OCS development under the Pribilof Island scenario would provide an alternative source of employment in the event that the domestic bottomfish industry fails to expand as forecasted.

Effect of Additional Mitigating Measures: See Section IV.B.4.b.

Cumulative Effects: See Section IV.B.4.b.

Unavoidable Adverse Effects: See Section IV.B.4.b.

(5) Impacts on Transportation Systems:

(a) Impacts on Marine Transportation Systems: Impacts on marine transportation systems would be the same as those described in Section IV.F.5. Overall tanker traffic as well as support and supply vessel traffic would not diminish from that which was postulated for the main transportation scenario for this alternative. Marine support traffic would emanate primarily from the Unalaska/Dutch Harbor area and tanker traffic would emanate from St. Paul. Rather than passing from a bay on the south side of the Alaska Peninsula away from the sale area the resultant tanker traffic would proceed out of the proposed sale area through Unimak Pass.

Impact on Air Facilities: Impacts on air facilities and systems would follow a similar pattern to those described in Sections IV.E.5 and IV.F.5. Should a terminal be located at St. Paul there would be a marked expansion of air facilities there and a dramatic increase of passenger enplanements. Impacts which would occur as a result of the optional scenario for St. Paul development would be greater than those which result from the south Alaska Peninsula transportation alternative. These impacts would not only be expressed in the construction of additional facilities but they would also be expressed in a vessel traffic configuration which would cause produced hydrocarbons to be transported out through Unimak Pass. Air traffic impacts would be reduced by the same precentage as stipulated for the south Alaska Peninsula transportation scenario associated with this alternative; however, significant impacts would accrue to the transportation systems of St. Paul and Unalaska. These impacts would be of such a nature as to cause: additional air traffic, renovation of airport runways; construction of: storage areas, aircraft maintenance areas and dormitories.

Conclusion: The transportation impacts associated with development of a terminal on St. Paul Island would be greater than those discussed in Section IV.F.5. The principal difference, however, between this section and Section IV.F.5. again lies in the fact that Unimak Pass would probably be used by tankers carrying any discovered hydrocarbons. The probability that the transportation systems will be impacted by this alternative is very likely, and given this interaction the probability of significant impact could be considered to be very likely. Indeed, the overall probability of impacts could be considered to be very likely.

Effect of Additional Mitigating Measures: Refer to Section IV.F.5.

Cumulative Effects: Refer to Section IV.F.5.

Unavoidable Adverse Effects: Refer to Section IV.F.5.

b. Makushin Bay Scenario: The following impact analyses are based on a scenario which entails transportation of oil by pipeline to a terminal located at the edge of Makushin Bay. From there, oil would be transported via Unimak Pass to unspecified location in the contiguous U.S.

Refer to Section II of this EIS for a more detailed description of this scenario. Only differences in impacts from those assessed for a similar scenario with the proposal (Sec. IV.B.7.b.) are discussed here.

(1) Impacts on Biological Resources:

(a) Impacts on Marine and Coastal Birds:

Site-Specific Impacts: With this alternative oilspill contact probabilities associated with a Makushin Bay/Unimak Pass transportation route are not significantly different from the proposal except near Bogoslof National Wildlife Refuge (Impact Zones 3-4), in the vicinity of western Unimak Pass (Impact Zones 5-8, 9-10), northeast of the pass (Impact Zones 11-12), and central shelf areas northwest of the pass (Impact Zones 14-17), where chance of spill contact is reduced from 82 to 59 percent, 94 to 62 percent, 56 to 29 percent, 32 to 0 percent, and 78 to 53 percent, respectively.

Conclusion: Probability of oilspill contact and potential interaction with birds is similar to the proposal except in a broad area surrounding western Unimak Pass, the areas northeast and northwest of the pass, and near Bogoslof National Wildlife Refuge, where average chance of interaction is reduced from likely to unlikely with this deletion. Because of sensitivity to oil, impacts on most species are likely to be significant, but regionally significant impacts are considered unlikely in these areas.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

(b) Impacts on Marine Mammals:

Site-Specific Impacts: With this alternative, oilspill contact probabilities associated with a Makushin Bay-Unimak Pass transportation scenario are not significantly different from the proposal except near Bogoslof National Wildlife Refuge (Impact Zones 3-4), in the vicinity of western Unimak Pass (Impact Zones 5-8, 9-10), northeast of the pass (Impact Zones 11-12), and central shelf areas northwest of the pass (Impact Zones 14-17). In these locations chance of spill contact is reduced from 82 to 59 percent, 94 to 62 percent, 56 to 29 percent, 32 to 0 percent, and 78 to 53 percent, respectively.

Conclusion: Probability of oilspill contact and potential interaction with marine mammals is similar to the proposal except in a broad area surrounding western Unimak Pass the areas northeast and northwest of the pass and near Bogoslof Island National Wildlife Refuge, where average chance of interaction is reduced from likely to unlikely. Because of sensitivity to oil, impacts on most species are likely to be significant, but regionally significant impacts are considered unlikely in these areas.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

(c) Impacts on Endangered Species: Appendix E, Table 26 shows that this alternative and transportation mode would generally reduce oilspill risk about 20 to 25 percent to the Unimak Pass region as might be incurred under the proposal and similar transportation scenario (Appendix E, Table 22). No major reduction in risk to offshore areas near the Pribilof Islands would be afforded. However, risk to the Unimak Pass region under Alternative V and a pipeline to an eastern Aleutian Island would be slightly higher than would be incurred under the proposal and if oil were piped towards the Alaska Peninsula (see Appendix E, Table 20). Risk to the Unimak Pass region asssociated with this mode of transportation for this alternative are 4 to 42 percent (Appendix E, Table 26, hypothetical targets 5-10) as compared to 0 to 8 percent if oil was transported toward the Alaska Peninsula (Appendix E, Table N20).

Conclusion: The probability of significant oilspill effects on endangered cetaceans as a result of this alternative would generally be less than those of the proposal even if oil is tankered out of the Bering Sea from a port on the Aleutian Islands. However, even greater reduction of risks to whale habitats in or near the sale area would be afforded by this alternative if oil would be transported by pipeline toward the port on the south side of the Alaska Peninsula.

Effect of Additional Mitigating Measures: See Section IV.B.1.d.

Cumulative Effects: See Section IV.B.1.d.

Unavoidable Adverse Effects: See Section IV.B.1.d.

(2) Impacts on Cultural Resources: This scenario would reduce impacts on cultural resources due to pipelines in the Pribilof Islands, a significant area for cultural resources.

Conclusion: Impacts on cultural resources would be less likely with this scenario than with a south Alaska Peninsula scenario.

Effect of Additional Mitigating Measures: Same as Section IV.F.3.

Cumulative Effects: Cumulative effects would be less than those described in Section IV.F.3.

Unavoidable Adverse Effects: Same as Section IV.F.3.

(3) Impacts on Economic Conditions: OCS employment impacts in the Aleutian Islands Census Division resulting from this scenario would be roughly 55 percent as great as indicated in Table IV.B.4.b.-6.

Conclusion: See Section IV.B.4.b.

Effect of Additional Mitigating Measures: See Section IV.B.4.b.

Cumulative Effects: See Section IV.B.4.b.

Unavoidable Adverse Effects: See Section IV.B.4.b.

c. Offshore Scenario: The following impact analyses are based on a scenario which entails processing and loading of oil and gas offshore.

Refer to Section II. for a more detailed discussion of this scenario. Only differences in impacts from those assessed for a similar scenario with the proposal (Sec. IV.B.7.c.) are discussed here.

(1) Impacts on Biological Resources:

(a) Impacts on Marine and Coastal Birds:

Site-Specific Impacts: With this alternative oilspill contact probabilties associated with an offshore loading Unimak Pass transportation route are not significantly different from the proposal except in the vicinity of western Unimak Pass (Impact Zones 5-8, 9-10), northeast of the pass (Impact Zones 11-12), and in central shelf areas northwest of the pass (Impact Zones 14-17) where chance of spill contact is reduced from 93 to 58 percent, 57 to 30 percent, 47 to 2 percent, and 94 to 74 percent, respectively.

Conclusion: Probability of oilspill contact and potential interaction with birds is similar to the proposal except in a broad area surrounding western

Unimak Pass, northeastward from the pass, and the central shelf area northwest of the pass, where average chance of interaction is reduced from likely to unlikely with this deletion. Because of sensitivity to oil, impacts on most species are to be significant, but regionally significant impacts are considered unlikely in these areas.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

(b) Impacts on Marine Mammals:

Site-Specific Impacts: With this alternative, oilspill contact probabilties associated with an offshore loading-Unimak Pass transportation scenario are not significantly different from the proposal except in the vicinity of western Unimak Pass (Impact Zones 5-8, 9-10), northeast of the pass (Impact Zones 11-12), and in central shelf areas northwest of the pass (impact Zones 14-17). In these locations, chance of spill contact is reduced from 93 to 58 percent, 57 to 30 percent, 47 to 2 percent, and 94 to 74 percent, respectively.

Conclusion: Probability of oilspill contact and potential interaction with marine mammals is similar to the proposal except in a broad area surrounding western Unimak Pass, northeastward from the pass, and the central shelf area northwest of the pass, where average chance of interaction is reduced from likely to unlikely with this deletion. Because of sensitivity to oil, impacts on most species are likely to be significant, but regionally significant impacts are considered unlikely in these areas.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

(c) Impacts on Endangered Species: Appendix E, Table N21 shows that oilspill risk associated with offshore loading and Alternative V are reduced in the areas of Unimak Pass and certain centralized offshore areas (represented by Hypothetical Targets 14-17) as compared to risk associated with the proposal and a similar transportation scenario (Appendix E, Table 31). Reduction in risk to the outer Unimak Pass region may be as much as 35 percent as compared to the proposal. However, these risks are not as low as those which may be associated with other transportation modes (see Section IV.F.1.d. or Appendix E, Table N22).

Conclusion: Probability of significant oilspill effects on endangered cetaceans as a result of this alternative would be less than those described for the proposal, particularly in the Unimak Pass area. However the reduction of risk would not be as great as that discussed in Section IV.F.1.d. and documented in Appendix E, Table N20.

Effect of Additional Mitigating Measures: See Section IV.B.1.d.

Cumulative Effects: See Section IV.B.1.d.

Unavoidable Adverse Effects: See Section IV.B.1.d.

(2) Impacts on Social Systems:

(a) Impacts on Community Infrastructure: Impacts on infrastructure (housing, utilities, education, etc.) with development of offshore loading and tankering operations could be 15 to 20 percent lower than the levels identified with development of a terminal on the south side of the Alaska Peninsula because of a lower dependence on all three communities to act as main bases for OCS operations.

Conclusion: St. Paul, Unalaska, and Cold Bay could all experience a decreased demand level below the levels associated with development of a terminal on the south side of the Alaska Peninsula.

Effect of Additional Mitigating Measures: The effectiveness of the mitigating measures would be the same as with development of a terminal on the south side of the Alaska Peninsula.

Cumulative Effects: Cumulative effects would remain the same as with development of a terminal on the south side of the Alaska Peninsula.

Unavoidable Adverse Effects: Unavoidable adverse effects would remain the same as identified with development of a terminal on the south side of the Alaska Peninsula.

(3) Impacts on Cultural Resources: Impacts on cultural resources located onshore would be reduced compared to those described for the south Alaska Peninsula scenario since there would be no onshore siting of terminal facilities.

Conclusion: Impacts from this scenario on cultural resources would be the same as those described in Section IV.F.3.

Effect of Additional Mitigating Measures: Same as Section IV.F.3.

Cumulative Effects: Same as Section IV.F.3.

Unavoidable Adverse Effects: Same as Section IV.F.3.

(4) Impacts on Economic Conditions: OCS employment impacts in the Aleutian Islands Census Division resulting from this scenario would be roughly 55 percent as great as indicated in Table IV.B.4.b.-7.

Conclusion: See Section IV.B.4.b.

Effect of Additional Mitigating Measures: See Section IV.B.4.b.

Cumulative Effects: See Section IV.B.4.b.

Unavoidable Adverse Effects: See Section IV.B.4.b.

(5) Impacts on Transportation Systems:

Impacts on Marine Transportation Systems: Impacts on marine transportation systems would be the same as those described in Section IV.F.5. Overall tanker traffic as well as support and supply vessel traffic would not diminish from that which was postulated for the main transportation scenario for this alternative. Marine support traffic would emanate primarily from the Unalaska/Dutch Harbor area and tanker traffic would emanate from or an offshore point. Rather than passing from a bay on the south side of the Alaska Peninsula away from the sale area the resultant tanker traffic would proceed out of the proposed sale area through Unimak Pass.

Impact on Air Facilities: Impacts on air facilities and systems would follow a similar pattern to those described in Sections IV.E.5 and IV.F.5. Under the offshore loading scenario, overall impacts to the air systems would be reduced (see Table IV.B.5-1). Impacts which would occur as a result of the optional scenario for offshore development would be greater than those which result from the south Alaska Peninsula transportation alternative. These impacts would not only be expressed in the construction of additional facilities but they would also be expressed in a vessel traffic configuration which would cause produced hydrocarbons to be transported out through Unimak Pass. Air traffic impacts would be reduced by the same precentage as stipulated for the south Alaska Peninsula transportation scenario associated with this alternative; however, significant impacts would accrue to the transportation systems of St. Paul and Unalaska. These impacts would be of such a nature as to cause: additional air traffic, renovation of airport runways; and construction of: storage areas, aircraft maintenance areas and dormatories.

Conclusion: The transportation impacts associated with offshore development would be greater than those discussed in Section IV.F.5. The principal difference, however, between this section and Section IV.F.5. again lies in the fact that Unimak Pass may be used by tankers carrying hydrocarbons. The probability that the transportation systems will be impacted by this alternative is very likely, and given this interaction the probability of significant impact could be considered to be very likely. The overall probability of impacts could be considered to be very likely.

Effect of Additional Mitigating Measures: Refer to Section IV.F.5.

Cumulative Effects: Refer to Section IV.F.5.

Unavoidable Adverse Effects: Refer to Section IV.F.5.

(6) Impacts on Coastal Zone Management: Development of offshore loading and tankering, with this alternative could result in less impacts occurring within the district CMP boundaries compared to impacts resulting from development of a terminal on the south side of the Alaska Peninsula.

Conclusion: Development of offshore loading and tankering could create less impacts to the district CMPs than development of a terminal on the south side of the Alaska Peninsula.

Effect of Additional Mitigating Measures: The measures suggested as effective for development of a bay on the south side of the Alaska Peninsula under Alternative V would also be effective for development of offshore loading and tankering, assuming those activities were within the boundaries of the CMPs.

Cumulative Effects: Cumulative effects upon the district CMPs under Alternative V would be the same as those experience if a terminal on the south side of the Alaska Peninsula were developed (Sec. IV.F.6.).

Unavoidable Adverse Effects: The development of offshore loading and tankering may create the same unavoidable adverse effects as those experienced with development of a terminal on the south side of the Alaska Peninsula under Alternative V.

G. Alternative VI - Deletion near Pribilof Islands and Unimak Pass

Modification of the proposal by deletion of 208 blocks located near the Pribilof Islands and the Unimak Pass. Refer to Section II.B.6. for a complete description of this alternative.

1. Impacts on Biological Resources:

a. Impacts on Fisheries: Shellfish resources in the vicinity of the Pribilof Islands benefit from the northern part of this deletion. The eastern deletion affords no benefits to either finfish or shellfish. While egg and larval forms of walleye pollock and tanner crab are found in this area, these species are widely distributed over much of the eastern Bering Sea during these life stages and the probability of significant numbers of their populations contacting an oilspill is very unlikely.

Yellowfin sole, Pacific cod, rockfish, and the other flatfishes of the eastern Bering Sea are out of range of contact by an oilspill originating from these deleted blocks.

Halibut adults and larvae in the area are generally at depths where they would not be contacted by oil.

Salmon and herring, with their limited seasonality and therefore limited vulnerability to an oilspill, are not benefitted by this deletion. This alternative is also outside the migration route for the Bristol Bay adult sockeye run.

Conclusion: The impact on fisheries would be the same as for Alternative IV. The probability of significant impact on demersal finfish is unlikely. Impacts on the fisheries resources of the south Alaska Peninsula would be reduced because the volumes of oil and gas transported would be reduced with this alternative compared to the proposal. This alternative would lessen the potential for habitat degradation from development facilities and oilspills in the terminal region on the south side of the Alaska Peninsula.

Effect of Additional Mitigating Measures: The effectiveness of mitigating measures for this alternative would be identical to those discussed for the proposal (see Sec. IV.B.1.a.).

Cumulative Effects: The cumulative effects associated with this alternative would not differ from those discussed in the proposal except for reduced exploratory activity and hence degree of cumulative effects.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as those discussed for the proposal.

Impacts on Commercial Fishing: American and foreign fishing vessels would benefit from this alternative in that oilspills, gear loss and/or damage, and vessel collision risk would be reduced. Possible loss of catch due to oil tainting would also be reduced. These reductions are derived by removal of extensive fishing areas from oil exploration and development.

Reduced loss of commercial finfish and shellfish species from oil pollution also offer minor benefit to the commercial fishing activity. The expected number of spills of 1,000 barrels or more are approximately halved, from 6.5 to 2.7 for the life of the project.

Conclusion: By removing relatively large areas from oil development, space-use conflicts between the fishing and oil industries are reduced. The end result would be reductions in loss and damages to commercial fishing vessels and equipment. These reductions are insignificant as probability of interaction is already assessed as unlikely. If interaction occurred, the probability of significant impact would be likely. The probability of that interaction would be unlikely.

Effect of Additional Mitigating Measures: The mitigating measures for alleviating conflicts between commercial fishing and oil development are the same for this alternative as for those discussed in the proposal.

Cumulative Effects: Adoption of this alternative with concurrent reduction in levels of oil exploration and development would reduce scheduled small boat harbor and airport construction for the region, as well as improved material supply associated with these improvements in commerce and transportation.

In the event that increased halibut populations allow for the re-opening of commercial fishing zones, then this alternative would cumulatively further benefit commercial fisheries.

Development of an American fishery for bottomfish would be enhanced by this alternative as potential adverse impacts on this new fishery related to oil development would be reduced.

Unavoidable Adverse Impacts: This alternative would not obviate the adverse and unavoidable impacts on the commercial fishing industry in regards to space conflicts, supply competition, or oil spills. They would not be reduced significantly from those described for the proposal.

b. Impacts on Marine and Coastal Birds: The principal effects of deleting both northwestern (Pribilof Islands) and southeastern (Unimak Pass) blocks would be to reduce the probability of oilspill contact with sensitive marine and coastal bird species foraging or otherwise active in the critical Pribilof Islands and Unimak Pass/eastern Aleutian intensive-use areas. By providing a buffer zone which removes the nearest potential spill sources, between the area of potential drilling activity and two of the most important areas for seabirds and waterfowl, deletion of both sets of blocks would reduce the risk of oilspill/bird interaction, although Unimak Pass in particular retains some risk as a result of tanker traffic. Elsewhere in the area there is little difference in probability of interaction. Disturbance from air traffic and human presence associated with oil and gas activities could have severe impacts on production by colonial species during the nesting season, adding to any effects on the populations caused by contact with oil at sea.

Site-Specific Imapacts: With these deletions, oilspill contact probabilities are significantly different from the proposal in the vicinity of western Unimak Pass (Impact Zones 5-8, 9-10), offshore shelf areas northeast and northwest of the pass (Impact Zones 11-12, 14-17), and marginally in the Pribilof Islands area (Impact Zones 21-24, 25-28), where risk of spill contact is reduced from 72 to 12 percent, 16 to 1 percent, 52 to 7 percent, 88 to 56 percent, 50 to 35 percent and 15 to 7 percent, respectively.

Conclusion: With this alternative, overall probability of oilspill contact and potential interaction with birds is reduced from likley to unlikley in two of the most important areas for foraging, migrating, and overwintering seabirds and waterfowl, the Pribilof Islands and Unimak Pass/eastern Aleutians. Although the most abundant species are highly oil sensitive, risk of regionally significant oilspill-seabird interactions occurring with this alternative is unlikely.

Effect of Additional Mitigating Measures: Effect of mitigating measures would be the same as the proposal (see Sec. IV.B.1.b.)

Cumulative Effects: See Section IV.B.1.b.

Unavoidable Adverse Effects: See Section IV.B.1.b.

c. Impacts on Marine Mammals: The principal effect of this alternative would be to reduce the probability of oilspill contact with sensitive marine mammal species foraging or otherwise active in the critical Pribilof Islands and Unimak Pass - eastern Aleutian intensive - use areas. By providing a buffer zone which removes the nearest potential spill sources, between the area of potential drilling acitvity and two of the most important areas for fur seals and sea lions, deletion of both sets of blocks would reduce the risk of oilspill--marine mammal interaction, although Unimak Pass in particular retains some risk as a result of tanker traffic. Elsewhere in the area there is little difference is probability of interaction. Disturbance from transportation activity and human presence also would decrease with this alternative. Potential disturbance and habitat degradation associated with construction of proposed projects on St. Paul and Unalaska Islands probably would not decrease with the alternative.

Site-Specific Impacts: With this alternative, oilspill contact probabilities associated with an Alaska Peninsula transportation scenario are significantly different from the proposal in the vicinity of western Unimak Pass (Impact Zones 5-8, 9-10), offshore shelf areas northeast and northwest of the pass (Impact Zones 11-12, 14-17), and marginally in the Pribilof Islands area

(Impact Zones 21-24, 25-28), where risks of spill contact are reduced from 72 to 12 percent, 16 to 1 percent, 52 to 7 percent and 15 to 7 percent, respectively.

Conclusion: With this alternative, overall probability of oilspill contact and potential interaction with marine mammals would be reduced from likely to unlikely in two of the most importance areas for foraging and migrating fur seals as well as sea lions, the Pribilof Islands and Unimak Pass-eastern Aleutians. Although fur seals are highly oil sensitive, risk of significant oilspill seal interactions occuring with this alternative is considered unlikely.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the proposal (Sec. IV.B.1.c.).

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

d. Impacts on Endangered Species and Non-Endangered Cetaceans: See Section IV.B.1-d for a general discussion of potential direct and indirect effects on endangered species and non-endangered cetaceans. (Unless otherwise specified, oil spill risk analyses made in this section refer to probabilities conditional in the development of a production field as described in Secs. II.A. and IV.A. and to associated 10-day, 1,000-bbl spill contact rates portrayed in Appendix E). As discussed previously under Sections IV.E.1.d and IV.F.1.d., deletion of blocks near the Pribilof Islands and near the southeastern lease area would eliminate potential spill source points which pose relatively high risks (if spills originate at those points) to offshore and nearshore areas known as endangered species habitat near the Pribilofs and Unimak Pass. Assuming development and oil resource potential as discussed previously, substantial reduction in risks to certain endangered species habitat would be afforded by this alternative as compared to the proposal. Appendix E, Table N22 shows that under this alternative there is a 0 to 7 percent chance that spills would move toward offshore areas north of Unimak Pass (Hypothetical Targets 5-8) as compared to 7 to 41 percent under the proposal (Appendix E, Table 20). These results apply only to a pipeline to Alaska Peninsula transportation scenario. Appendix E, Table N22 also shows that Unimak Pass nearshore areas north of Unimak Island (Hypothetical Targets 9-10) would be under 0 to 1 percent chance of spill contact under this alternative as opposed to 0 to 16 percent under the proposal. Spill risks to the Pribilof Islands offshore areas (e.g., Hypothetical Targets 22-24, 26-27) are also under less risk than would be incurred under the proposal. Therefore, it can be concluded that it is likely that spills and endangered species and non-endangered cetaceans and and/or their habitats would interact as a result of this alternative, but to a substantially lower extent that would be incurred under the proposal. Given the seasonality of endangered species occurrence, as well as their broad dispersion throughout the area, it is unlikely that such interaction, if it occurred, would lead to significant effects on such populations. Therefore, it is very unlikely that significant impacts due to oilspills would occur for endangered species as a result of this alternative.

This alternative probably would not provide a substantial reduction of potential effects of noise and disturbance on endangered species and non-endangered cetaceans as compared to the proposal, although localized reduction of potential disturbance could be incurred, particularly for species frequenting offshore habitats.

Conclusion: It is likely that oil spills would interact with endangered species and non-endangered cetaceans and/or their habitats. However, if it occurred, it is very unlikely that such interaction would have significant direct or indirect impacts on endangered (or non-endangered) whale populations. Therefore, significant oilspill interaction with such species is very unlikely as a result of this alternative.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be essentially the same as discussed for the proposal (Sec. IV.B.1.d.).

Cumulative Effects: Cumulative effects on endangered species and non-endangered cetaceans would be essentially the same as discussed for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects associated with this alternative would be essentially the same as discussed for the proposal.

2. Impacts on Social Systems:

a. Impacts on Population: The amount, characteristics, and distribution of population for Alternative VI would be substantially the same as Alternative V with the south peninsula terminal scenario (Sec. IV.F.2.a.).

Conclusion: Impacts on population would be the same as Alternative V.

Effect of Additional Mitigating Measures: Same as Alternative V.

Cumulative Effects: Same as Alternative V.

Unavoidable Adverse Effects: Same as Alternative V.

b. Impacts on Subsistence: Impacts on subsistence are considered in terms of potential effects from population concentrations and oil pollution incidents. The amount, characteristics, and distribution of population for Alternative VI would be substantially the same as Alternative V using the south peninsula terminal scenario. The results of the Oilspill Risk Analysis for this Alternative, using the south peninsula terminal scenario, are the same as Alternative V (Sec. IV.F.2.b.).

Conclusion: Impacts on subsistence would be the same as Alternative V.

Effect of Additional Mitigating Measures: Same as Alternative V.

Cumulative Effects: Same as Alternative V.

Unavoidable Adverse Effects: Same as Alternative V.

c. Impacts on Fishing Village Livelihood: Impacts on fishing village livelihood are considered in terms of potential effects from oil pollution incidents. The results of the Oilspill Risk Analysis for this alternative, using the south peninsula terminal scenario, are the same as Alternative V (Sec. IV.F.2.c.).

Conclusion: Impacts on fishing village livelihood would be the same as Alternative V.

Effect of Additional Mitigating Measures: Same as Alternative V.

Cumulative Effects: Same as Alternative V.

Unavoidable Adverse Effects: Same as Alternative V.

d. Impacts on Sociocultural Systems: Impacts on sociocultural systems are contextual questions surrounding impacts potentially contributed by population concentrations and oil pollution incidents. Based on the south peninsula terminal scenario, potential effects from population and oilspill incidents for Alternative VI would be substantially the same as Alternative V (Sec. IV.F.2.d.).

Conclusion: Impacts on sociocultural systems would be the same as Alternative V.

Effect of Additional Mitigating Measures: Same as Alternative V.

Cumulative Effects: Same as Alternative V.

Unavoidable Adverse Effects: Same as Alternative V.

e. Impacts on Community Infrastructure: This alternative may decrease the impacts to St. Paul, Unalaska, and Cold Bay from those values identified in Alternative I, assuming a pipeline terminal and tankering operation is located at a bay on the south side of the Alska Peninsula. Due to the lower projected values for resources under this alternative, levels of impacts may be decreased by half for all three communities.

St. Paul: Due to the decreased level of resources projected as available under this alternative, demands for housing, utilities, education, etc., could be decreased by 65 percent from the levels identified in Alternative I.

Unalaska: Due to the decresed level of resources projected as available under this alternative, demands for housing, utilities, education, etc., could be decreased by 50 percent from the levels identified in Alternative I.

Cold Bay: Due to the decreased level of resources projected as available under this alternative, demands for housing, utilities, educaiton, etc., could be decreased by 50 percent from the levels identified in Alternative I.

Conclusions: St. Paul, Unalaska, and Cold Bay could experience substantially decreased impacts under this alternative when compared to Alternative I. The probabilities of interaction between infrastructure and oil and gas development for St. Paul and Unalaska are unlikely. The probabilities of significant impacts assuming there are interactions are unlikely. The overall probabilities of significant interactions are unlikely.

Effect of Additional Mitigating Measures: The effectiveness of the mitigating measures would be the same as for the proposal (see Sec. IV.B.2.e.).

Cumulative Effects: Cumulative effects would remain the same as described for the proposal (see Sec. IV.B.2.e.).

Unavoidable Adverse Effects: Unavoidable adverse effects would remain the same as described for the proposal (see Sec. IV.B.2.e.).

3. Impacts on Cultural Resources: Deletion of the blocks near the Pribilof Islands and the blocks near Unimak Pass would exclude an area of high probability of prior human habitation (see Sec. III.D.3.) near the Pribilof Islands. This alternative would reduce the chance of interaction between oil exploration/development activities and marine archaeological sites and lessen the impact of OCS employment-related population on the entire coast. The reduction of impacts from deletion of the blocks near the Unimak Pass would reduce impacts on historic shipwrecks which are likely to be present in that area (see list of shipwrecks in Table III.D. and Technical Paper No. 2 (Tornfelt, 1981)) by reducing the number of adverse interactions. The blocks in this area are of low probability of prior human habitation, so that deletion of the blocks would not appreciably lower the number of interactions to marine cultural resources. Adverse interactions for onshore cultural resources on Federal and other lands, especially the Cold Bay area, would be reduced because of the reduction of OCS employment-related population (see Sec. IV.E.4.). The reduction in tanker and ship traffic supporting exploration and development of both the Pribilof and Unimak blocks would reduce adverse interactions due to oilspills on cultural resources.

Conclusion: This alternative would lower the final significant impact of the proposal from likely to very unlikely.

Effect of Additional Mitigating Measures: The adoption of the orientation and cultural resources mitigating measures (see Sec. II.B.1.c.) would slightly reduce the final probability of significant impacts of this alternative.

Cumulative Effects: The cumulative effects associated with Alternative VI would be much the same as those described for the proposal. Interaction of the activities of these projects with activities which would have been present during exploration and development of the Pribilof and Unimak Pass blocks would not occur. As a result, impacts will be reduced to an estimated 10 percent. The probability of significant impact would remain very unlikely.

Unavoidable Adverse Effects: The accidental impacts on cultural resources mentioned for the proposal would be lessened to very unlikely.

4. Impacts on Economic Conditions:

a. Impacts on State and Regional Economies: The economic impact of proposed OCS petroleum development activities is expected to be minor in areas of Alaska other thant the Aleutian Islands Census Division in which the development would occur. For that reason, this DEIS does not discuss the statewide and regional economic impacts.

b. Impacts on Local Economy (Defined as the Economy of the Aleutian Islands Census Division, with Emphasis on Selected Communities): Overall employment and population impacts in the Aleutian Islands Census Division resulting from the south side of the Alaska Peninsula scenario would be roughly 45 percent as great as indicated in Table IV.B.4.b.-1.

Conclusion: Refer to Section IV.B.4.b.

Effect of Additional Mitigating Measures: Refer to Section IV.B.4.b.

Cumulative Effects: Refer to Section IV.B.4.b.

Unavoidable Adverse Effects: Refer to Section IV.B.4.b.

5. Impacts on Transportation Systems: This alternative would have the effect of: (1) Lowering the estimated oil and gas tnakerage to 40 percent of that of the proposed action, (2) reducing overall barge traffic entering Unalaska during the developmental period to some 50 to 55 percent of that forecast for the proposed action, (3) eliminating at least 90 monthly work boat trips (during the developmental period), (4) eliminating 45 daily helicopter flights during the exploratory period and 135 flights during the developmental period, and (5) reducing manpower requirements and, hence, enplanement requirements by at least 25 percent.

Conclusion: This alternative would result in a substantial reduction of impacts compared to Alternative I (proposal) perhaps as much as 40 percent. However, stress on air transport and, to a lesser degree, marine facilities would remain at rather heavy levels. The probability that this alternative would interact with the transportation systems is very likely. Given this interaction the probability of significant impact would be likely. The overall probability of significant impact would be likely.

Effect of Additional Mitigating Measures: Refer to the discussion in Section IV.B.5.

Cumulative Effects: Refer to the discussion in Section IV.B.5.

Unavoidable Adverse Effects: Refer to the discussion in Section IV.B.5.

6. Impacts on Coastal Zone Management: Deletion of blocks near the Pribilof Islands and Unimak Pass, with development of a terminal on the south side of the Alaska Peninsula would not be expected to adversely affect the potential district Coastal Management Programs (CMPs) for the Aleutian/Pribilof Islands region. Impacts, if any, to the Pribilof Islands or the Aleutian Islands could be diluted due to the greater distance away from the proposed sale area.

Conclusion: Impacts could be reduced near the Pribilof Islands and the Aleutian Islands northeast of Unimak Pass.

Effect of Additional Mitigating Measures: Effective mitigation of oil and gas impacts under this alternative would be the same as identified for the proposal (see Sec. IV.B.6.).

Cumulative Effects: Cumulative effects would be the same as with the proposal (see Sec. IV.B.6.).

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as with the proposal (see Sec. IV.B.6.).

7. Impacts on Other Transportation Scenarios: The three developmental and transportation scenarios, described below, are presented in order to analyze differences in impacts. These are presented to give the decisionmaker an understanding of the expected impacts if development siting and transportation systems were to differ from those of the south side of the Alaska Peninsula scenario.

a. Pribilof Island Scenario: This scenario which entails transportation of oil by pipeline to a terminal located on one of the Pribilof Islands would not be reasonable or viable if Alternative VI were selected. Therefore, further discussion is not warranted.

b. Makushin Bay Scenario: The following impact analyses are based on a scenario which entails transportation of oil by pipeline to a terminal located at the edge of Makushin Bay. From there, oil would be transported via Unimak Pass to an unspecified location in the contiguous U.S.

Refer to Section II of this EIS for a more detailed description of this scenario. Only differences in impacts from those assumed for a similar scenario with the proposal (Sec. IV.B.7.b.) are discussed here.

(1) Impacts on Biological Resources:

(a) Impacts on Fisheries: Impacts on fisheries would be reduced compared to those described in Section IV.B.7.b. (proposal, Makushin Bay scenario).

Effect of Additional Mitigating Measures: Same as the proposal (see Sec. IV.B.1.a.).

Cumulative Effects: Same as the proposal (see Sec. IV.B.1.a.).

Unavoidable Adverse Effects: Same as the proposal (see Sec. IV.B.1.a.).

(b) Impacts on Marine and Coastal Birds:

Site-Specific Impacts: With this alternative, oilspill contact probabilities associated with a Makushin Bay/Unimak Pass transportation route are significantly different from the proposal in the vicinity of Bogoslof National Wildlife Refuge (Impact Zones 3-4), in the vicinity of western Unimak Pass (Impact Zones 5-8, 9-10), offshore shelf area northeast and northwest of the pass (Impact Zones 11-12, 14-17), and marginally in the Pribilof Islands area and at shelfbreak (Impact Zones 21-24, 25-28, 19-20), where risk of spill contact is reduced for 82 to 51 percent, 94 to 55 percent, 56 to 24 percent, 32 to 0 percent, 78 to 46 percent, 47 to 34 percent 14 to 7 percent and 45 to 34 percent, respectively.

Conclusion: With this alternative, overall probability of oilspill contact and potential interaction with birds is reduced from likely to unlikely in two of the most important areas for foraging, migrating and overwintering seabirds and waterfowl, the Pribilof Islands area and Unimak Pass/eastern Aleutians. Although the most abundant species are highly oil sensitive, risk of regionally significant oilspill/seabird interactions occurring with these deletions is considered unlikely.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

(c) Impacts on Marine Mammals:

Site-Specific Impacts: With this alternative, oilspill contact probabilities associated with a Makushin Bay-Unimak Pass transportation scenario are significantly different from the proposal in the vicinity of Bogoslof National Wildlife Refuge (Impact Zones 3-4), in the vicinity of western Unimak Pass (Impact Zones 5-8, 9-10), offshore shelf area northeast and northwest of the pass (Impact Zones 11-12, 14-17), and marginally in the Pribilof Islands area and at shelfbreak (Impact Zones 21-24, 25-28, 19-20), where risk of spill contact is reduced for 82 to 51 percent, 94 to 55 percent, 56 to 24 percent, 32 to 0 percent, 78 to 46 percent, 47 to 34 percent 14 to 7 percent and 45 to 34 percent, respectively.

Conclusion: With this alternative, overall probability of oilspill contact and potential interaction with marine mammals is reduced from likely to unlikely in two of the most important areas for foraging, migrating, and breeding, the Pribilof Islands area and Unimak Pass/eastern Aleutians. Although fur seals and sea otters are highly oil sensitive, risk of regionally significant oilspill-marine mammal interactions occurring with these deletions is considered unlikely.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

(d) Impacts on Endangered Species and Non-Endangered Cetaceans: Comparison of oilspill risks to cetacean habitats portrayed in Appendix E, Tables N24, 26, N18, and 22 shows that this alternative would reduce oilspill risk associated with this transportation mode more than Alternative IV or V as compared to the proposal. However, oilspill risk to Unimak Pass region and certain offshore areas in the lease area proper would still be relatively high.

Conclusion: Probability of significant effects of oilspills on endangered whale populations or habitats related to this mode of transportation and this alternative would be essentially the same as discussed in Section IV.F.7.b. (Alternative V).

Effect of Additional Mitigating Measures: See Section IV.B.1.d.

Cumulative Effects: See Section IV.B.1.d.

Unavoidable Adverse Effects: See Section IV.B.1.d.

(2) Impacts on Social Systems: The impacts experienced with development of a Makushin Bay terminal would be substantially the same as with development of a terminal on the south side of the Alaska Peninsula under Alternative VI for population, sociocultural systems, subsistence, fishing village livelihood, and community infrastructure.

Conclusion: Impacts would be the same as Section IV.G.2.

Effect of Additional Mitigating Measures: Same as Section IV.G.2.

Cumulative Effects: Same as Section IV.G.2.

Unavoidable Adverse Effects: Same as Section IV.G.2.

(3) Impacts on Cultural Resources: Using the Makushin Bay terminal scenario with this alternative would remove pipeline hazards from culturally sensitive blocks in the Pribilof and Unimak areas. This reduces the probability of interaction of oil and gas activity with cultural resources located in these sensitive blocks. The probability of significant impact for this alternative was already rated as very unlikely.

Conclusion: The impacts to cultural resources would be less likely with this scenario than with a south Alaska Peninsula scenario.

Effect of Additional Mitigating Measures: Same as Section IV.G.3.

Cumulative Effects: Cumulative effects would be reduced with this scenario compared to those described in Section IV.G.3.

Unavoidable Adverse Effects: Same as Section IV.G.3.

(4) Impacts on Economic Considerations: OCS employment impacts in the Aleutian Islands Census Division resulting from this scenario would be roughtly 45 percent as great as indicated in Table IV.B.4.b.-6.

Conclusion: See Section IV.B.4.b.

Effects of Additional Mitigating Measures: See Section IV.B.4.b.

Cumulative Effects: See Section IV.B.4.b.

Unavoidable Adverse Effects: See Section IV.B.4.b.

(5) Impacts on Transportation Systems:

Impacts on Marine Traffic: In comparison with the south Alaska Peninsula transportation scenario, the other transportation scenarios differ only again in the pattern of tanker traffic. The size of vessel used as well as the number of vessel tanker trips forecast on an annual basis should remain the same as discussed in Section IV.G.5. Under this alternative, the Makushin Bay scenario would feature tanker traffic proceeding out the Unimak Pass whereas the main transportation alternative will feature tankerage which would proceed away from a bay on the Alaska Peninsula.

Impacts on Air Transportation Systems: The impact of air transportation systems in this alternative, utilizing the Makushin Bay scenario, will have a precentage impact reduction the same as that described for the south Alaska Peninsula transportation scenario. Table IV.B.5-1 shows traffic levels associated with each possible transportation scenario. Given a substantial reduction in aircraft traffic (35%) and in light of the rather moderate impacts of peak developmental period traffic, it is probable that the impact to the Unalaska/Dutch Harbor airport would probably be moderate.

Conclusion: The impacts on air transportation systems which would result from a Makushin Bay scenario would not be quantatively different from those described for the south Alaska Peninsula transportation scenario for this alternative (Sec. IV.G.5.). However two impact situations would differ from that of south Alaska Peninsula transportation scenario. First, vessel traffic (tankers) would probably proceed through Unimak Pass. Second, the air facilities at Unalaska/ Dutch Harbor may suffer moderate impacts and need renovations.

Effective of Additional Mitigating Measures: See Section IV.G.5.

Cumulative Effects: See Section IV.G.5.

Unavoidable Adverse Effects: See Section IV.G.5.

(6) Impacts on Coastal Zone Management: Development of a pipeline to a terminal and tankering from Makushin Bay, could create less impacts to the Pribilof Islands and Aleutian Islands northeast of Unimak Pass than those experienced with development of a terminal on the south side of the Alaska Peninsula.

Conclusion: Development of a terminal at Makushin Bay could create less impacts under this alternative from impacts created if a bay on the south side of the Alaska Peninsula were developed.

Effect of Additional Mitigating Measures: The mitigating measures suggested as effective for development of a terminal on the south side of the Alaska Peninsula under Alternative VI would also be effective for development of a terminal at Makushin Bay.

Cumulative Effects: Cumulative effects would be the same for development at Makushin Bay as for development of a bay on the south side of the Alaska Peninsula.

Unavoidable Adverse Effects: These effects would be the same as those experienced if a terminal on the south side of the Alaska Peninsula was developed under Alternative VI.

c. Offshore Scenario: The following impact analyses are based on a scenario which entails processing and loading of oil and gas offshore.

Refer to Section II for a more detailed discussion of this scenario. Only the differences in impacts from those assumed for a similar scenario with the proposal (Sec. IV.B.7.c.) are discussed here.

(1) Impact on Biological Resources:

(a) Impacts to Fisheries:

Conclusion: Impacts on fisheries would be slightly reduced from those described for an offshore scenario under the proposal (see Sec. IV.B.7.c.).

Effect of Additional Mitigating Measures: These would be the same as those discussed for the proposal (see Sec. IV.B.1.a.).

Cumulative Effects: See Section IV.B.1.a.

Unavoidable Adverse Effects: These would be the same as those discussed for the proposal (see Sec. IV.B.1.a.).

(b) Impacts on Marine and Coastal Birds:

Site-Specific Impacts: Under this alternative oilspill contact probabilities associated with an offshore loading/Unimak Pass transportation route are significantly different from the proposal in the vicinity of western Unimak Pass (Impact Zones 5-8, 9-10), offshore shelf areas northeast and northwest of the pass (Impact Zones 11-12, 14-17), and marginally at shelfbreak (Impact Zones 19, 20), where risk of spill contact is reduced from 93 to 51 percent, 57 to 24 percent, 47 to 2 percent, 94 to 68 percent, and 56 to 44 percent, respectively.

Conclusion: Under this alternative, overall probability of oilspill contact and potential interaction with birds is reduced from likely to unlikely in two of the most important area for foraging, migrating, and overwintering seabirds and waterfowl, the Pribilof Islands area and Unimak Pass/eastern Aleutians. Although the most abundant species are highly oil sensitive, risk of regionally significant oilspill/seabird interactions occurring with these deletions is considered unlikely.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

(c) Impact on Marine Mammals:

Site-Specific Impacts: With this alternative, oilspill contact probabilities associated with an offshore loading-Unimak Pass transportation scenario are significantly different from the proposal in the vicinity of western Unimak Pass (Impact Zones 5-8, 9-10), offshore shelf areas northeast and northwest of the pass (Impact Zones 11-12, 14-17), and marginally at shelfbreak (Impact Zones 19-20), where risk of spill contact is reduced from 93 to 51 percent, 57 to 24 percent, 47 to 2 percent, 94 to 68 percent, and 56 to 44 percent, respectively.

Conclusion: With this alternative, overall probability of oilspill contact and potential interaction with marine mammals is reduced from likely to unlikely in two of the most important areas for foraging, migrating and breeding, the Pribilof Islands area and Unimak Pass - eastern Aleutians. Although fur seals and sea otters are highly oil sensitive, risk of regionally significant oilspill-marine mammal interactions occurring with these deletions is considered unlikely.

Effect of Additional Mitigating Measures: The effect of mitigating measures would be the same as for the proposal.

Cumulative Effects: Cumulative effects would be the same as for the proposal.

Unavoidable Adverse Effects: Unavoidable adverse effects would be the same as for the proposal.

(d) Impacts on Endangered Species and Non-Endangered Cetaceans: Comparison of oilspill risks portrayed in Appendix E, Tables 27, N21, N19, and 31 shows that this alternative would reduce oilspill risk to cetacean habitats of the Unimak Pass region and certain offshore areas in the lease area proper more than Alternativs IV or V (as compared to the proposal). However as compared to Alternative V, reductions are only about 5 to 15 percent.

Conclusion: The probability of significant oilspill-related effects on endangered and non-endangered cetaceans are essentially the same as discussed in Section IV.F.7.c.

Effect of Mitigating Measures: See Section IV.B.1.d.

Cumulative Effects: See Section IV.B.1.d.

Unavoidable Adverse Effects: See Section IV.B.1.d.

(2) Impacts on Social Systems: The impacts experienced with development of offshore loading and tankering operations would be substantially the same as with development of a terminal on the south side of the Alaska Peninsula under Alternative VI for population, sociocultural systems, subsistence, fishing village livelihood, and community infrastructure.

Conclusion: See Section IV.G.2.

Effect of Additional Mitigating Measures: See Section IV.G.2.

Cumulative Effects: See Section IV.G.2.

Unavoidable Adverse Effects: See Section IV.G.2.

(3) Impacts on Cultural Resources: Using the offshore loading and tankering scenario with this alternative would increase the likelihood of oilspills contacting cultural resources. With this scenario, the pipeline risk to marine cultural resources is not present. There would be no change in the overall likelihood of impacts using this scenario.

Conclusion: Impacts from offshore loading to cultural resources would be the same as those described in Section IV.G.3.

Effect of Additional Mitigating Measures: Same as Section IV.G.3.

Cumulative Effects: Same as Section IV.G.3.

Unavoidable Adverse Effects: Same as Section IV.G.3.

(4) Impacts on Economic Considerations: OCS employment impacts in the Aleutian Islands Census Division resulting from this scenario would be roughtly 45 percent as great as indicated in Table IV.B.4.b.-7.

Conclusion: See Section IV.B.4.b.

Effect of Additional Mitigating Measures: See Section IV.B.4.b.

Cumulative Effects: See Section IV.B.4.b.

Unavoidable Adverse Effects: See Section IV.B.4.b.

(5) Impacts on Transportation Systems:

Impacts on Marine Traffic: In comparison with the south Alaska Peninsula transportation scenario, this transportation scenario differs in the pattern of tanker traffic. The size of vessel used as well as the number of vessel tanker trips forecast on an annual basis should remain the same as discussed in Section IV.G.5. Under this scenario tanker traffic would probably proceed out the Unimak Pass area.

Impacts on Air Transportation Systems: The impact of air transportation systems in this alternative, utilizing the offshore loading scenario, will have a percentage impact reduction the same as that described for the south Alaska Peninsula transportation scenario. Table IV.B.5-1 shows traffic levels associated with each possible transportation scenario. Given a substantial reduction in aircraft traffic (35%) and in light of the rather moderate impacts of peak developmental period traffic, the impact to the Unalaska/Dutch Harbor airport would probably be moderate.

Conclusion: The impacts on air systems which would result from an offshore loading scenario would not be quantatively different from those described for the south Alaska Peninsula transportation scenario for this alternative (Sec. IV.F.5.). However, vessel traffic (tankers) would probably proceed through Unimak Pass and the air facilities at Unalaska/ Dutch Harbor may suffer moderate impacts and need renovations.

Effective of Additional Mitigating Measures: See Section IV.G.5.

Cumulative Effects: See Section IV.G.5.

Unavoidable Adverse Effects: See Section IV.G.5.

(6) Impacts on Coastal Zone Management: Development of offshore loading and tankering with the alternative of deleting blocks near the Pribilof Islands and Unimak Pass in the Aleutian Islands, could result in less impacts occurring within the district CMP boundaries compared to impacts resulting from development of a terminal on the south side of the Alaska Peninsula.

Conclusion: Development of offshore loading and tankering could create less impacts to the district CMPs than development of a terminal on the south side of the Alaska Peninsula.

Effect of Additional Mitigating Measures: The measures suggested as effective for development of a bay on the south side of the Alaska Peninsula under Alternative VI would also be effective for development of offshore loading and tankering, assuming those activities were within the boundaries of the CMP.

Cumulative Effects: Cumulative effects upon the district CMPs under Alternative VI would be the same as those experienced if a terminal on the south side of the Alaska Peninsula was developed.

Unavoidable Adverse Effects: The development of offshore loading and tankering may create less unavoidable adverse impacts than those experienced with development of a terminal on the south side of the Alaska Peninsula under Alternative VI.

H. Impacts on Other Issues

1. Impacts On Water Quality:

a. Impacts on the Proposal (Alternative I): Environmental impact assessment of drilling fluid disposal upon marine receiving waters has been thoroughly discussed in the appendices to three separate EIS's and is incorporated herein: FEIS on OCS Sale 65 (BLM, 1978) and Final Supplement on the EIS on OCS Sale 42 (BLM, 1979). Additionally, the FEIS on OCS Sale 60 (BLM, 1981) as well as the DEIS on OCS Sale 46 (BLM, 1980) discuss water quality impacts of previous Alaskan OCS leasing proposals.

OCS exploratory vessels and production platforms will discharge drilling fluids in bulk quantities, along with lower level releases of petroleum hydrocarbons, and sanitary wastes from waste water discharge sources. OCS production platforms will also be discharging bulk quantities of petroleum formation waters. The construction of pipelines and dredge and fill operations associated with harbor development would yield sediment suspension in the water column.

The above types of water quality impacts are considered to be insignificant. Several factors contribute to this finding:

(a) Drilling fluid and formation water releases quickly become non-toxic in marine receiving waters with moderate depth and circulation. Moreover, rig monitoring studies have shown that the toxic contaminants in drilling fluids and formation waters typically dilute to background concentrations of marine receiving waters within a few hundred meters of the discharge source.

(b) Discharges of all types of contaminants from offshore OCS exploration and production operations are the subject of the National Pollution Discharge Elimination System (NPDES) permitting program mandated under the Clean Water Act. Under this program, EPA establishes discharge limitations for various waste water contaminants that will not interfere with beneficial uses of marine receiving waters. Refer to Alaska OCS Technical Paper No. 4 for further discussion of EPA's Federal Water Pollution Control Act responsibilities with regard to OCS water pollution sources. Additionally, implementation of Section 5 of the Port and Tanker Safety Act will eliminate the mixing of ballast water and oil thus reducing operational pollution that could result from the discharge of ballast from oil tankers.

(c) OCS construction operations yielding sediment loading and resuspension in receiving waters of this region are minor in volume and import in comparison to natural processes which occur. Storm surges and oceanographic conditions in the Bering Sea result in bottom disturbances which exceed the impacts from pipeline construction.

The construction and development of sites used for marine support bases during the exploration phase and onshore processing and terminal complexes during the development phase could result in dredge and fill operations. Sediment loading and suspension of materials would result from these operations, however, the permitting requirements of the U.S. Army Corps of Engineers under Section 404 of the Federal Water Pollution Control Act would provide mitigating practices to minimize the impacts on marine receiving waters.

Conclusion: No significant impacts on water quality are anticipated from this proposed action.

Effect of Additional Mitigating Measures: No suggested mitigating measures apply to reduction of water quality impacts. The applicable regulations derive from Federal and state non-discretionary statutory requirements.

Cumulative Effects: Cumulative effects on water quality may be observed from additional development projects in the southeastern Bering Sea region. Oil and gas leasing in the territorial waters of this region would yield waste water discharges. Construction of small boat harbors at Unalaska and St. Paul

Island and the expansion of the bottomfishing industry would yield sediment loading and waste water discharges. It is difficult to judge the significance of these additional impacts in the absence of site-specific information on the volume of effluent loading, the contaminants being discharged, and the mixing characteristics of the receiving waters. Cumulative water quality impacts from subsequent development proposals can be evaluated in future EIS's on major actions.

Unavoidable Adverse Effects: No unavoidable adverse effects on water quality are anticipated from the proposed action because the impacts are tractable to mitigation.

b. Impacts of Alternatives II through VI: Under Alternative II, no impacts on water quality would occur. Under Alternatives III-VI the impacts would be substantially the same as under the proposal, Alternative I. Water quality impacts are not differentiated for alternatives because the impacts are site-specific with the location of OCS operations. Thus, block deletion options do not effectively change the nature of the water quality impacts associated with the specific alternative.

2. Impacts on Air Quality:

a. Impacts of the Proposal (Alternative I): Impacts on air quality from the proposal are expected to be insignificant. This finding of no significant impact on air quality refers to all alternatives to the proposal. Air quality impacts ensuing from this proposal are expected to be analogous to those identified in the EIS's on OCS sales 46 and 60 for the following reasons: (a) Air quality assessment on proposed OCS sales in Alaska is based on pristine ambient air quality conditions; (b) The air quality assessment of offshore emission sources is based upon emissions inventory and pollutant trajectories from individual exploratory vessels or production platforms; (c) The onshore air pollutant levels from individual offshore emissions sources is estimated to be insignificant as shown in the DEIS on proposed sale 46 and the EIS on sale 60; and (d) Onshore emission sources in frontier OCS development areas are expected to be no greater than existing ambient concentrations in the Kenai-Nikiski area where petroleum production, refining, gas liquefaction, and marine loading operations occur. No violations of any national or state air quality standards or U.S. EPA Prevention of Significant Deterioration requirements are anticipated.

This finding of no significant impact on air quality assumes the application of mitigating measures in place. These mitigating measures include the statutory responsibilities of EPA regarding onshore emission sources, and USGS regulations regarding offshore OCS emission sources. Refer to Alaska OCS Technical Paper No. 4 for a description of the relevant air pollution control authorities of EPA and USGS.

Conclusion: Types of impacts that could be anticipated from the proposed action would be insignificant degradation of the existing regional air quality. Types of pollutants emitted during OCS oil and gas operations would be ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, visibility-reducing particles, and suspended particulate matter. The probability of interaction between the proposed action and regional air quality is very unlikely. The impacts would not be significant if the interaction occurs. The overall probability of significant interaction is very unlikely. The combined effect of increased marine traffic and industrial activity of the projected domestic bottomfishing industry and OCS oil and gas support activity could possibly degrade air quality at Unalaska by some unknown amount.

Effect of Additional Mitigating Measures: Applicable mitigating measures derive from Federal and state non-discretionary statutory requirements rather than from the potential measures described in Section II.B.1.b. and c.

Cumulative Effects: Cumulative effects on air quality may be observed from those projects listed in Section IV.A.7. The proposed small boat harbors at St.Paul and Unalaska will increase marine traffic. The proposed airport expansion at Unalaska could bring additional aircraft operations to that area. The additional Federal OCS proposals for hydrocarbon drilling and that proposed for the Southwest Bristol Bay Uplands may yield increased ambient pollutant concentrations in particular locations. However, these emissions are not expected to violate any ambient air quality standards.

Unavoidable Adverse Effects: No unavoidable adverse effects on air quality are anticipated from the proposed action because the impacts could be mitigated.

b. Impacts of Alternative II through VI: Under Alternative II, no impacts on air quality would occur. Under Alternatives III through VI, the impacts would be substantially the same as under the proposal, Alternative I. Air quality impacts are not differential across alternatives because the impacts are site-specific with the location of OCS operations. Thus, block deletion options do not effectively change the nature of the air quality impacts associated with the specific alternative.

3. Impacts on Land Status and Land Use:

a. Impacts of the Proposal (Alternative I): Land status describes the legal ownership of the lands, configuration of land parcels (e.g., alternating or contiguous parcels owned by state, Federal, or private interests) and the non-Federal rights or privileges attached to the parcel of land, as opposed to land use, which describes the actual, physical purpose or function which that parcel serves (e.g., housing, industry, recreation, etc.). The high majority of impacts will be on land use, not land status.

There is no major impact expected on the land status of the Aleutian/Pribilof Islands region due to the proposed lease sale. Minor impacts could occur if a movement originates from the oil and gas industry to purchase land from private or Native ownership as opposed to leasing the land area.

A significant impact on land use could arise, due to the small amount of available land in the Aleutian/Pribilof Islands region. Most of the land in the area is already committed to Federal withdrawals (e.g., Alaska Maritime National Wildlife Refuge (NWR), Izembek NWR, etc.), or to private uses (Native corporation selections, residential, commercial, industrial, etc.). If there were large amounts of vacant land available, land use impacts could be significantly reduced or minimized. The total amount of acreage allotted to any combined onshore oil and gas processing complex is expected to be 200 to 225 hectares (500-550 acres).

Secondary land use demands would occur in conjunction with demands for residential, commercial, industrial, public and open space lands. Changes in the land use pattern from secondary demands are expected to be of low significance. New land use, such as onshore staging areas, temporary construction camps, pipe coating yards, supply bases, etc. could preclude potential uses of areas originally projected for use as commercial, residential, industrial, or recreational developments.

The bottomfishing industry is likely to impact the OCS-related land use substantially especially as boat areas, warehouse areas, and residential areas are likely to be competing for land utilized or desired for OCS activities. Secondary land use demands in conjunction with the bottomfish industry are likely to require additional space and could preclude other projected or potential land uses.

Many of the impacts from land use development could be mitigated by land use planning efforts by the cities and villages. Unalaska/Dutch Harbor has a land use plan completed in 1977, which would need updating to react to potential OCS-related or bottomfishing-related industry developments.

Spillover effects, that is, those indirect development activities resulting from a commercial find of OCS hydrocarbons, are difficult to estimate primarily because they depend on the decision to develop a find and the resulting site-specific location decisions. This EIS is not directed towards an analysis of OCS development activities. Land use and land status impacts resulting from the decision to develop a find of OCS hydrocarbons would be analyzed in a future EIS based on OCS development and production plans submitted by industry.

Conclusion: The proposed lease sale is not expected to affect the land status of the Aleutian/Pribilof Islands region. Minor impacts could result from changes in land use at the local level with short-term gains from selling or leasing lands to accommodate petroleum-related facilities.

The probability of an interaction occurring between land use and OCS activities under the proposed action is likely. The probability of a significant impact occurring if there is an interaction is unlikely. The overall probability of a significant interaction is unlikely.

Effect of Additional Mitigating Measures: The suggested mitigating measures may not be responsive to alleviating potential land use or land status impacts. Local land-use regulation and site planning could mitigate most adverse effects.

Cumulative Effects: The small boat harbor at St. Paul is not likely to create a major impact on land use in St. Paul. Development of a small harbor could preclude development of a harbor large enough to support OCS facilities. However, it is also possible that development of a small boat harbor could act as a catalyst to expanding the harbor area to a size suitable for OCS-related activities.

The Unalaska airport expansion should not create a major impact to land use in the Unalaska/Dutch Harbor area. The area proposed for expansion is not suitable for other forms of land use (e.g., residential, commercial, industrial).

Expansion of the airport could bring more traffic to the area, thus creating secondary demands for land to be used as residential, commercial, or industrial space.

The proposal for the Cherinofski Point fishing community would impact the land use, in that most of the area is already conveyed to the Natives, with the remainder scheduled to be conveyed shortly.

Unavoidable Adverse Effects: Land use impacts associated with the proposal are avoidable rather than unavoidable, as impacts resulting from the proposed lease sale could be mitigated by site planning, land use regulations, and so forth. Loss of wilderness areas to development could be adversely affected for the life of the project.

b. Impacts to Alternatives II through VI: Alternative II (no sale) would create minimal, if any, impacts on the area, as the land use changes would be ones to occur without the impetus of OCS development. Bottomfishing industry expansion would have some impact, in that it would require additional residential land to house the increased population associated with the industry, and commercial or industrial land to house processing plants or onshore support facilities. Alternative III (delay the sale) would only act to delay the impacts associated with OCS development. Under this alternative, impacts would be the same as with the proposal, only delayed 2 years (see Sec. IV.H.3.a.). Impacts from Alternatives IV, V, and VI would be substantially the same as with the proposal, except that the likelihood of permanent onshore facilities on the Pribilof Islands for Alternatives IV and VI and on Unimak Island and nearby Akutan Island and the lower Alaska Peninsula for Alternatives V and VI may be substantially decreased.

4. Impacts on Visual, Wilderness, and Recreational Resources:

a. Impacts of the Proposal (Alternative I): The amount of visual impact would depend on each day's visibility, the season, the structure of the landscape, the location of the observer, the distance the viewed object is from the viewer, the social psychological perspectives and values towards the resource (USDI, 1978; U.S. Dept. of Agriculture, 1977). A presumption is made that visual impacts may occur in significant viewshed locations in the coastal zone where offshore and onshore OCS development would be intrusions on an uninterrupted view. This criterion of visual impact is used in absence of a viewers preference or visual assessment survey.

There are many viewing areas on the Alaska Peninsula and the Aleutian Islands (see Sec. III.H.4.). Anyone climbing into the foothills or peaks is likely to encounter scenic views far surpassing those of the lower coastal plains. Near the proposed sale area, there are six areas that contain noteworthy viewsheds. They are: Katmai National Park, Cold Bay, Izembek Lagoon, Ikatan Bay and the Unimak-Pass shores, Unalaska/Dutch Harbor, and the Pribilof Islands. The Katmai area offers a park trail from Naknek to the Pacific shore through the area of the 1912 volcanic eruption of Mt. Katmai. In these viewer locations, a visual impact may occur for viewers from higher promontories due to rigs and OCS tanker ship traffic. Many places such as Cold Bay with its World War II quonset huts, Dutch Harbor with its World War II pill boxes and World War II barracks; and the Pribilof Village area with Federal buildings and seal hunting provide unique visual experience of human past. Change in the appearance of area due to increased visitation resulting from OCS-related population increases in these locations would likely occur. Much would depend on which transportation scenario were selected. Since most structures would be at least 50 kilometers (31 mi) from shore, visual impacts would be due mostly to barges, tugs, ships, tankers, and other support vessels except when aircraft with passengers fly over these vessels and drillrigs for the purpose of viewing. Major and minor Alaska-based airlines conduct scenic tours along the Aleutian coast to the Pribilof Islands. Annually, thousands of people take these tours. On a clear day, the views encountered in these scenic flights would very likely be altered by tankers, ships, support development facilities, and roads. Cloudy weather in the area reduces the number of viewing days per year and the distance of viewing. See Table IV.H.4.a.-1 for details. Since viewing is limited to fewer days the impact of OCS-related facilities to the viewscape on a clear day is of likely significance.

Impacts on wilderness values are difficult to define because of the subjective nature of the wilderness experience. Legislative and administrative definitions of wilderness fix the absence of any human habitation, structure, or manifested alterations to the environment as basic to the wilderness experience (Wilderness Act of 1964, 16 U.S.C. 1131). No legislatively designated wilderness lands would be directly affected by the sale 70 leasing proposal. OCS operations may, to a minor degree, affect the wilderness experience of individuals who come to the Aleutian Islands or the Alaska Peninsula, because certain Federal lands have wilderness value even though they are not legislatively designated as wilderness.

Impacts to recreation may occur from 1) competition in the use of existing recreational facilities in Cold Bay, Unalaska/Dutch Harbor, St. George, or St. Paul or any one of the villages near oil and gas exploration and development facilities, 2) recreational hunting and fishing conflicts between local residents and OCS personnel or OCS-related population, 3) displacement through reassignment of use of the lands and sites of recreational and/or park value, or reassignment of local and regional recreational facilities to industrial uses. The likelihood and magnitude of these types of recreational impacts depends primarily on the location and magnitude of the OCS activities and personnel onshore, together with any regulations and mitigating measures used to avoid adverse interaction (see Sec. II.B.c.). Interaction is likely. This has occurred to the benefits of the recreational community in other parts of Alaska. This positive impact would likely to occur here also.

Conclusion: There is likelihood of recreational, visual, and wilderness impacts from increased population due to OCS operations in Cold Bay, Unalaska/Dutch Harbor, St. George, and/or St. Paul. Impacts would not necessarily be adverse. Some positive impact associated with oil and gas development for recreation may ensue if oil money or taxes can circulate into the villages and cities to be used for swimming pools, gymnasiums, community centers, sports, and recreation programs. The probability of visual interaction with exploration rigs would be unlikely due to the distance and the relatively few viewing days. However, if the weather was good and visual interactions occurred, proposed OCS sale 70 activities, such as ship traffic, tankering, barge and tug operations, would make visual impacts likely. Since there are few viewing days, the significance of such impacts would be likely.

Table IV.H.4.a.-1
Obstruction to Vision for Selected Locations-Percentage Frequency of Occurrence

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Average
Attu	14.4	16.9	14.4	14.7	10.5	22.7	44.3	38.3	14.5	5.5	6.5	6.8	17.5
Shemya	32.6	32.8	31.8	28.9	28.1	30.8	32.8	27.8	22.5	26.5	30.6	29.7	29.6
Amchitka	20.1	17.1	18.9	28.9	27.3	52.2	75.7	70.8	42.2	22.3	20.7	20.1	34.5
Adak	8.4	7.4	8.3	8.0	12.2	25.5	34.7	32.3	20.4	9.6	8.3	9.1	15.3
Nikolski	26.9	19.4	22.6	27.2	35.4	57.1	72.9	66.3	40.9	16.7	17.4	16.2	35.4
Dutch Harbor	12.5	10.6	8.8	3.9	5.3	14.8	22.3	17.2	16.1	7.5	2.7	4.7	10.5
Driftwood Bay	20.1	27.0	24.0	28.6	33.5	41.3	46.1	43.2	34.6	18.7	20.4	21.7	29.9
Cold Bay	21.1	19.1	17.0	12.7	12.0	18.0	28.3	32.4	18.0	9.5	13.4	17.6	18.4
Port Moller	17.7	20.9	26.2	33.6	23.5	35.0	40.0	35.2	18.1	18.6	22.4	24.9	26.4
Port Heiden	58.1	47.6	44.1	37.8	20.4	46.7	59.1	60.2	34.4	25.8	31.1	40.9	42.2
Saint Paul	24.2	27.3	25.3	22.3	30.4	40.8	56.1	43.6	23.8	8.5	12.2	17.2	27.6
Cape Newenham	31.4	29.5	31.9	33.0	28.7	29.5	37.6	34.9	18.7	13.7	23.8	30.9	28.6
Cape Romanzof	35.4	38.3	39.7	38.6	26.5	24.3	28.6	25.9	17.2	14.1	25.6	31.2	28.8
Bethel	15.0	11.5	11.8	9.9	6.6	6.0	11.2	16.0	9.7	7.8	10.1	11.8	10.6
Aniak	8.4	6.2	5.6	5.0	3.7	3.6	8.3	10.4	5.3	5.4	5.6	7.4	6.2
King Salmon	9.4	7.0	7.8	5.7	5.6	9.0	15.4	16.0	6.3	5.6	7.8	9.6	8.8
McGrath	11.2	7.1	4.7	4.8	1.7	3.4	5.6	7.4	4.1	6.5	7.2	13.4	6.4
Sparrevohn	17.2	22.5	17.9	16.7	8.4	10.5	15.3	14.21	10.6	21.0	23.8	12.8	16.7

The conditions creating the obstruction to vision are rain or drizzle, snow or sleet, fog, or blowing snow. The frequency of occurrence of these conditions without regard to obstruction to vision are given in Figure 21.

Prepared by AEIDC from Air Weather Service data.

Effect of Additional Mitigating Measures: If the orientation stipulation were to include information about local visual, wilderness, and recreational resources and warn against certain practices which could increase the number of interactions between OCS activities and these resources, the probability of impacts would be lowered from unlikely to very unlikely due to a reduction in the number of interactions. The use of enclave type support and development facilities would reduce unlikely impacts to very unlikely.

Cumulative Effects: The additional and interactive impacts of other projects in the sale 70 area would increase the impacts on visual, wilderness, and recreational resources by an estimated 10 percent within the impact category of the proposal. (For details on major projects considered for this analysis, see Sec. IV.A.7.) Small boat harbors at St. Paul and Unalaska, a fishing community at Chirinofski Point, three Federal sales (57, 75, and 83) and the state proposed sale in southwest-Bristol Bay Uplands together would likely change the visual, wilderness, and recreational value of the area.

Unavoidable Adverse Effects: Unavoidable adverse impacts on visual and wilderness resources may occur if offshore OCS operations are visible from significant onshore and coastal viewpoints. It is unlikely that all facility areas can be returned to their natural state if they are once located in areas of scenic, recreational, and wilderness value. Therefore, it is likely that interaction with visual, recreational, and wilderness resource would occur but it is unlikely that they would be abundant enough to be of significance. The final probability of significant unavoidable adverse impact is unlikely.

b. Impacts of Alternatives II through VI: Under Alternative II, no impacts on visual, wilderness, and recreational resources would occur. Under Alternative III the impacts would be the same as the proposal, but delayed. Under Alternative IV the impacts may be lessened an estimated 5 percent of final impact for the Pribilof Islands since blocks in that locality are deleted. For Alternative V the deletion of the Unimak Pass would lower the impact an estimated 5 percent in the Cold Bay area since traffic may be lowered with resulting reduction in interactions. The combined deletions of the Pribilof Island blocks and the Unimak Pass blocks (Alternative VI) would lower the probability of final significant impact by an estimated 10 percent.

5. Impacts on Terrestrial Mammals:

a. Impacts of the Proposal:

Effects on Brown Bear: Effects of OCS oil and gas development on brown bears is expected to result from onshore support and development activities on the Alaska Peninsula rather than from oil pollution itself. Oilspills that reach coastal habitats and contaminate carrion could have local impact, especially in spring and fall when bears spend much time foraging along beaches. The effect of ingested oil on cubs, or, for example, adult reproductive physiology is unknown at present, but the number of individuals involved is unlikely to affect the peninsula population significantly.

Of major concern is the potential for human disturbance and habitat degradation associated with onshore facilities anticipated for the Alaska Peninsula. Construction activities, increased air traffic, increased hunting pressure and other contacts with humans all may combine to disrupt behavioral patterns and drive bears from habitats preferred for breeding, denning, and foraging.

Effects on Caribou: Likewise, effects on caribou are expected to result primarily from disturbance and habitat degradation associated with human activity. Of particular concern is the possibility of displacement of caribou from traditional calving grounds, preferred foraging habitats, and insect relief areas. Migratory movements of the peninsula herd are erratic but could be disrupted by road and other construction. Caribou are easily disturbed by aircraft as well as by vehicle traffic and other ground activities, and if disturbance from various sources were sustained during critical periods, such as calving or rut, or during periods when they are most susceptible to disease and predation, the herd could be seriously impacted. Off-road vehicle traffic and borrow pits for construction materials, as well as construction of a cross-peninsula pipeline, could alter or eliminate important caribou habitats.

Conclusion: Neither brown bears nor caribou are likely to be impacted significantly by offshore OCS activities. However, disturbance resulting from interaction with onshore activities is considered likely. If occurring when animals are particularly sensitive or sustained over long periods, such interactions are likely to have significant impacts on peninsula populations of these species. Thus, significant interactions resulting from disturbance is considered likely.

Effect of Additional Mitigating Measures: Information to Lessees (Bird and Mammal Protection) is the most effective protection measure available to this agency by which terrestrial mammals can be protected from disturbance by support and construction activities. Existing hunting regulations could further mitigate disturbance of terrestrial mammal populations. Burial of any cross-peninsula pipeline may mitigate partially the effects of such construction on caribou movements.

Cumulative Effects: Activities which may produce cumulative effects on terrestrial mammals include other Federal proposed or future OCS lease sales, state of Alaska proposed or future lease sales, and subsistence or other harvests. It is unknown how extensive cumulative effects of disturbance on terrestrial mammal populations might be.

Unavoidable Adverse Effects: The extent of unavoidable adverse effects associated with this proposal is unknown, but may be limited primarily to localized but presently unidentified effects of disturbance. However, since long-term effects of disturbance currently are unknown, they may be considered unavoidable.

b. Impacts of Alternative II through VI: Under Alternative II, no impacts on terrestrial mammals would occur. Under Alternative III, effects would be delayed until some future time. Under Alternatives IV through VI, reduced resource presumably would result in decreased level of onshore activity and construction, thereby decreasing the potential for impact on terrestrial mammal populations.

I. Relationship Between Local Short-Term Uses and Maintenance and Enhancement of Long-Term Productivity

In this section, the short-term effects and uses of various components of the environment of the St. George Basin area are related to long-term effects and the maintenance and enhancement of long-term productivity. The effects of the proposed action would vary in kind, intensity, and duration, beginning with preparatory activities (seismic data collection and exploration drilling) of oil and gas development, and ending when natural environmental balances might be restored.

In general, short-term refers to the useful lifetime of the proposal, but some even shorter-term uses and effects are considered. Long-term refers to that time beyond the lifetime of the proposal. The producing life of the field development in the St. George Basin area has been estimated to be about 21 years for oil and 31 years for gas. In other words, short-term refers to the total duration of oil and gas exploration and production, whereas long-term refers to an indefinite period beyond the termination of oil and gas production. This period will vary from one environmental component to another.

Many of the impacts discussed in Section IV are considered to be short-term (being greatest during the construction, exploration, and early production phases), which could be further reduced by the mitigating measures discussed in Section II.B.1. Additional measures that could be initiated by the state and local communities that would significantly reduce economic inflation and social impacts include rent controls discussed in Section IV.B.4.

Biological productivity would be lost in the short term on all onshore lands used in the proposed project. These areas could be returned to productivity in the long term with proper management. Restoration may not be entirely feasible; however, the overall loss would be a minor adverse effect. The direct land requirements, as shown in the hypothetical development scenario, would show in both the short-term and the long-term because of disturbance. Major construction projects on the south side of the Alaska Peninsula would cause definite changes in both the short term and long term. Some species may have difficulty repopulating and could be displaced. This would also be true of the other locations hypothesized for a terminal siting.

Short-term oil pollution and the possibility of long-term cumulative oil pollution impacts could cause serious adverse effects on all components of the marine ecosystem, including fisheries. While restoration would allow fisheries production to regain original levels, any reduced annual harvests during the life of the project would be irretrievably lost. The extent is not known presently, but the potential must be recognized.

Freshwater pollution from onshore activities is a short-term effect. The long-term decrease in water quality may be considered to be a tradeoff for obtaining oil and gas resources.

The biota would be threatened in the short-term by potential oil pollution. Direct mortality could be significant through the combined effects of harassment by humans and the increased volume and frequency of noise from vessel traffic or overflying aircraft. In the long term, such disturbances could alter behavior patterns and could drive fauna away from traditional feeding and breeding grounds or to other critical areas within their range, reducing species populations over a long period of time.

Habitat destruction could cause a reduction in subsistence species, such as salmon, which could threaten the regional economy. The improved accessibility to primitive areas from increased construction is a short-term result of this proposal. This overall wilderness value of the coast may decrease from increased land use. Increased human populations in the short term could change the regional Native culture in the long term. The subsistence way of life could be modified and population shifts could occur. The overall changes cannot be termed positive or negative, except by those affected.

Archaeologic and historic values discovered during development would enhance long-term knowledge. Overall, finds may help to locate other sites, but destruction of artifacts would represent long-term losses.

Consumption of offshore oil and gas would be a long-term use of non-renewable resources. Economic, political, and social benefits may accrue from the availability of oil and gas. Most benefits would be short-term and would decrease the nation's dependency on oil imports. If additional supplies were discovered and developed, the proposed production system would enhance extraction.

The production of oil and gas from the St. George Basin area would provide short-term, critically needed energy, and perhaps, provide time either for the development of long-term alternative energy sources or substitutes for petroleum feedstocks. Petroleum development in these areas may mean the irreplaceable loss of some fisheries production. The maintenance and enhancement of long term productivity would depend on efforts to control water quality levels. Regional planning would aid in controlling changing economics and populations, and thus, in moderating any adverse impacts.

Alternatives to the proposal, such as cancellation, delay, and partial deletion options reduce to varying degrees both the long- and short-term environmental effects, as well as the long- and short-term energy supply benefits, as explained in the preceding impact sections.

J. Irreversible and Irretrievable Commitment of Resources

1. Minerals Resources: The mean resource estimates of the proposed action are 1.120 billion barrels of oil and 3.66 trillion cubic feet of natural gas. Should these resources be discovered, they would be irretrievably consumed.

2. Biological Resources: Commercial fishery losses may occur principally by oilspills interfering with salmonid migrations or by their direct contact with larval fishes and/or their planktonic food supplies. Any losses of commercial fishing incomes attributable to this proposal would be irreversible and irretrievable to the extent they were uncompensated. Unharvested commercial finfish and shellfish, as renewable resources, would be irretrievably lost to the economy.

Increased air and ship traffic and onshore activities, as well as potential habitat degradation or reduction in available food resulting from oil and gas industry operations could displace birds and mammals into less favorable environments, ultimately resulting in reduced population levels. The total amount of acreage allotted to any combined onshore oil and gas processing complex is expected to be 200 to 225 hectares (500-550 acres). Displacement could become irretrievable if permanent alterations of the environment were maintained by such activities.

3. Endangered Species: Under the proposal, it is possible that endangered whales could be subjected to irreversible direct and indirect effects of oilspills, disturbance due to noise and other human activities, or losses and/or deterioration of habitat due to facility developments. Whether such effects would lead to permanent (irreversible) losses of whale resources is unknown.

4. Social Systems: Village subsistence practices could be affected irreversibly by the displacement of subsistence resources from locally-used customary habitat or by the reduction of resources through the modification of favorable habitat. The displacement could be irretrievable if the effect were maintained over time. Irreversible changes in cultural values and orientations could occur from the proposal, but the irretrievable nature of these changes to sociocultural systems is unknown.

A high growth situation could cause increased housing costs and shortages and could place extreme demands on utility services such as electrical power, water, sewage, and solid waste disposal for St. Paul, Unalaska, and Cold Bay. Attempts by these communities to provide basic service levels for the above items to meet increased population levels could force the communities to forego improvements to the existing, and sometimes substandard, services.

Due to the increase in air and marine traffic generated by this proposed action and, importantly, the severely inclement weather to which the area is prone, it is highly probable that there would be an increase in transportation related fatalities over the life of the proposal.

5. Economic Systems: The only commitment that could be considered possibly irreversible and irretrievable would be the economic risk, resulting from OCS activity, of destruction of commercial fisheries resources or destruction of other fauna or flora used for subsistence by area residents.

6. Cultural Resources: The destruction of an underwater OCS cultural site would possibly result in an irreversible and irretrievable loss of prehistoric information about human occupancy of the Bering Land Bridge.

V.

CONSULTATION AND COORDINATION

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B. Development of the Proposal

The proposed OCS sale for the St. George Basin (No. 70) is one of 36 proposed OCS sales included in the 5-Year OCS Oil and Gas Leasing Schedule. Official coordination with other government agencies, industry, and the public regarding this proposal began on June 22, 1979.

At that time, BLM requested resource reports from all Federal agencies with expertise pertinent to the proposal and the proposed sale area. Next, on July 27, 1979, a Call for Nominations and comments was issued, which requested expressions of industry interest in blocks within the call area and requested comments on environmental issues related to possible oil and gas leasing in the area. Responses were received from 14 companies and numerous state and Federal agencies, conservation groups, and individuals.

Following evaluation of the tract nominations and environmental information received in the process described above, BLM and USGS submitted a joint recommendation for tract selection to the Secretary. On February 27, 1980, the Department of the Interior announced the selection of 479 blocks for further environmental study. (See Sec. I.A. for more detail.)

C. Development of the DEIS

During preparation of this DEIS, Federal, state, and local agencies; industry; and the public have been consulted in order to obtain descriptive information, to identify significant impacts and issues, and to identify effective mitigating measures and reasonable alternatives to the proposal. The information received has been used in preparing the DEIS. In addition, scoping meetings were held following tract selection with Federal, state, and local agencies, and the public in order to identify more clearly and specifically issues and alternatives to be studied in the DEIS. A list of scoping meetings can be found in Section D, below.

Departmental Manual Part 655 DM 1 details procedures for intradepartmental coordination regarding OCS oil and gas leasing. Departmental agencies with interest and expertise in the OCS were consulted, in accordance with these procedures, during the development of the proposed lease stipulations for this proposal (see Sec. II.B.1.c.).

D. Scoping Meetings for Sale 70

The scoping process for proposed lease sale 70 consisted of the following meetings conducted by members of the Alaska OCS Office.

1. Akutan: Public meeting held February 27, 1980.

2. Anchorage:

    a. Meeting with representatives from the Bristol Bay Native Association held March 25, 1980.

    b. Public meeting at the Alaska Center for the Environment held April 9, 1980.

    c. Meeting with representatives from Federal and State agencies and the public held April 15 and 16, 1980.

3. Cold Bay: Public meetings held February 26, 1980 and April 3, 1981.

4. Dillingham: Public meeting held May 1, 1980.

5. Juneau: Meeting with representatives from Federal and State agencies on April 23, 1980.

6. King Cove: Public meeting held February 26, 1980.

7. Nikolski: Public meeting held February 27, 1980.

8. Port Heiden: Public meeting held March 31, 1981.

9. St. George: Public meetings held February 28, 1980, April 24, 1980, and April 1, 1981.

10. St. Paul:

a. Public meeting held February 28, 1980.

b. Meeting with Victor Merculief, Mayor; and Mike Zacharof and Alexander Golanin, representatives of the Tanadgusix Corporation held February 28, 1980.

c. Meeting with Victor Merculief; Larry Merculief, President of the Tanadgusix Corporation; and Mike Zacharof held April 1, 1981.

10. Unalaska:
a. Public meetings held February 26, 1980, April 22, 1980, and April 2, 1981.

b. Meeting with Jess Burton, City Manager held April 22, 1980.

11. Washington, D.C.: Alaska OCS Office representation at the Pribilof Islands Fur Seal Hearings held April 28-30, 1980.

Refer to Section I.F. for the summary of scoping results.

E. List of Contacts for Preparation and Review of the Draft Environmental Impact Statement (DEIS)

Federal, state, and local government agencies; academic institutions; industrial firms; special interest groups; and private citizens were consulted prior to and during the preparation of this environmental impact statement. Agencies, groups, and individuals contacted for information as well as review of the DEIS are listed below.

Federal Agencies

- Department of Agriculture
    - Forest Service
- Department of Commerce
    - Bureau of Economic Analysis
    - National Marine Fisheries Service
    - National Oceanic and Atmospheric Administration
    - Office of Coastal Zone Management
    - Office of Ecological and Environmental Conservation
    - OCSEAP Office, Juneau

- Department of Defense
    - Air Force
    - Army Corps of Engineers
    - Department of the Army
    - Naval Operations
- Department of Energy
    - Alaska Field Office
    - Economic Regulatory Administration
    - Federal Energy Regulation Commission
    - Leasing Policy Development
- Department of the Interior
    - Bureau of Indian Affairs
    - Bureau of Land Management, State Director
    - Bureau of Mines
    - Fish and Wildlife Service
    - Geological Survey
    - Heritage Conservation and Recreation Service
    - National Park Service
    - Office of Aircraft Services
    - Special Assistant to the Secretary
- Department of Transportation
    - Coast Guard
- Department of the Treasury
- Environmental Protection Agency

State of Alaska

- The Honorable Jay S. Hammond, Governor
- Department of Administration
- Department of Commerce and Economic Development
- Department of Community and Regional Affairs
- Department of Environmental Conservation
- Department of Fish and Game
- Department of Health and Social Services
- Department of Labor
- Department of Law
- Department of Natural Resources
- Department of Public Works
- Department of Revenue
- Department of Transportation and Public Facilities
- Office of Coastal Management
- Office of the Governor
    - Division of Policy Development and Planning, State-Federal Coordinator

Universities

- University of Alaska
    - Department of Anthropology - Steve Langdon, Ph.D.
    - Marine Advisory Program
- Washington State University - Pullman
    - Department of Rural Sociology - William Freundenberg, Ph.D.
- University of California - Irvine, David Schneider, Ph.D. and George L. Hunt, Jr., Ph.D.
- University of California - Santa Barbara, W. Holmes, Ph.D.

Native Organizations

- Aleut Corporation
- Aleutian/Pribilof Islands Association, Inc.
- Association of Village Council Presidents
- Bristol Bay Native Association
- Ounalashka Corporation
- Tanadgusix Corporation
- Tanaq Corporation

Special Interest Groups

- Acoustical Society of America
- Alaska Center for the Environment
- Alaska Conservation Society
- Alaska Geological Society, Inc.
- Alaska League of Women Voters
- Alaska Miners Association
- Alaska Oil and Gas Association
- Alaska Professional Hunters Association
- Alaska Public Interest Res. Group
- Alaska Wildlife Federation and Sportman's Council, Inc.
- Audubon Society, Anchorage Chapter and National Representative
- Bertha's Brokerage
- Chugach Gem and Mineral Society
- Environmental Center, West Anchorage High School
- Friends of Animals
- Friends of the Earth
- Geophysical Society of Alaska
- Greenpeace Alaska
- Isaac Walton League of America
- Moening-Grey and Assoc., Inc.
- Oil Watch
- Resource Development Council
- Rural CAP
- Sierra Club
- Trustees for Alaska
- Wilderness Society

Additional Contacts

- Advisory Council on Historic Preservation, Louis S. Wall
- Aleutian Islands Region School District, Richard Bower, Superintendent
- ATCO
- Atlantic Richfield Company, Alaska, Inc.
- Canadian Wildlife Service
- Richard Careaga, City Planner, Unalaska
- John Christensen, Port Heiden
- Dames and Moore, Consultants
- Marine Construction and Engineering Company
- Pan Alaska Fisheries
- Science Applications, Inc.
- John Sevy, City Manager, King Cove and Sand Point

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APPENDIX A

LIST OF BLOCKS COMPRISING THE PROPOSED ACTION, INCLUDING DISTANCE FROM SHORE, WATER DEPTH, AND SIZE

Prepared By
The Alaska OCS Office

ALASKA,OCS REPORT DATE [illegible] [illegible] [illegible] OF SELECTED OCS DATA OPTION 1

MAP #	BLK	HCTRS	RFS	DEPTH	PLN	MAP #	BLK	HCTRS	RFS	DEPTH	PLN	MAP #	BLK	HCTRS	RFS	DEPTH	PLN
241	19	2304.00	102	134	NPH	241	255	2304.00	86	110	NPH	241	346	2304.00	77	112	NPH
241	20	2304.00	104	135	NPH	241	256	2304.00	78	108	NPH	241	347	2304.00	75	111	NPH
241	63	2304.00	103	134	NPH	241	261	2304.00	77	106	NPH	241	348	2304.00	74	109	NPH
241	64	2304.00	105	135	NPH	241	262	2304.00	76	102	NPH	241	349	2304.00	73	109	NPH
241	65	2304.00	107	132	NPH	241	272	2304.00	97	134	NPH	241	350	2304.00	72	107	NPH
241	107	2304.00	102	134	NPH	241	273	2304.00	99	134	NPH	241	365	2304.00	102	136	NPH
41	108	2304.00	105	133	NPH	241	279	2304.00	102	134	NPH	241	366	2304.00	104	135	NPH
241	109	2304.00	107	133	NPH	241	280	2304.00	105	133	NPH	241	367	2304.00	106	135	NPH
241	110	2304.00	111	131	NPH	241	281	2304.00	108	133	NPH	241	368	2304.00	108	135	NPH
241	212	2304.00	87	114	NPH	241	282	2304.00	109	134	NPH	241	369	2304.00	105	135	NPH
241	213	2304.00	85	112	NPH	241	300	2304.00	83	115	NPH	241	370	2304.00	103	134	NPH
241	214	2304.00	84	111	NPH	241	301	2304.00	82	114	NPH	241	371	2304.00	102	134	NPH
241	215	2304.00	83	108	NPH	241	302	2304.00	80	112	NPH	241	372	2304.00	101	133	NPH
241	216	2304.00	82	106	NPH	241	303	2304.00	79	110	NPH	241	373	2304.00	100	131	NPH
241	217	2304.00	80	103	NPH	241	304	2304.00	78	109	NPH	241	374	2304.00	99	131	NPH
241	218	2304.00	79	101	NPH	241	305	2304.00	75	107	NPH	241	375	2304.00	97	130	NPH
241	233	2304.00	96	134	NPH	241	306	2304.00	74	105	NPH	241	376	2304.00	96	129	NPH
241	234	2304.00	97	134	NPH	241	321	2304.00	98	135	NPH	241	377	2304.00	95	125	NPH
241	235	2304.00	100	134	NPH	241	322	2304.00	102	134	NPH	241	378	2304.00	93	127	NPH
241	236	2304.00	103	134	NPH	241	323	2304.00	103	133	NPH	241	379	2304.00	92	125	NPH
241	237	2304.00	105	134	NPH	241	324	2304.00	106	134	NPH	241	380	2304.00	90	125	NPH
241	238	2304.00	109	133	NPH	241	325	2304.00	110	134	NPH	241	381	2304.00	89	123	NPH
241	256	2304.00	84	115	NPH	241	326	2304.00	108	134	NPH	241	382	2304.00	86	123	NPH
241	257	2304.00	83	113	NPH	241	344	2304.00	79	115	NPH	241	383	2304.00	84	121	NPH
241	258	2304.00	82	111	NPH	241	345	2304.00	73	114	NPH	241	384	2304.00	82	121	NPH

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ALASKA OCS [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] DATA OPTION 1

MAP #	BLK	HCTRS	FFS	DEPTH	PLN	MAP #	BLK	HCTRS	FFS	DEPTH	PLN	MAP #	BLK	HCTRS	FFS	DEPTH	PLN
241	385	2304.00	80	117	NPH	241	422	2304.00	91	127	NPH	241	459	2304.00	99	134	NPH
241	386	2304.00	80	117	NPH	241	423	2304.00	[illegible]	125	NPH	241	460	2304.00	97	134	NPH
241	387	2304.00	78	117	NPH	241	424	2304.00	89	125	NPH	241	461	2304.00	94	133	NPH
241	388	2304.00	76	116	NPH	241	425	2304.00	87	124	NPH	241	462	2304.00	93	133	NPH
241	389	2304.00	75	114	NPH	241	426	2304.00	84	123	NPH	241	463	2304.00	92	132	NPH
241	390	2304.00	73	112	NPH	241	427	2304.00	82	121	NPH	241	464	2304.00	91	131	NPH
241	391	2304.00	72	111	NPH	241	428	2304.00	80	120	NPH	241	465	2304.00	90	130	NPH
241	392	2304.00	70	110	NPH	241	429	2304.00	79	119	NPH	241	466	2304.00	90	128	NPH
241	393	2304.00	70	109	NPH	241	430	2304.00	77	118	NPH	241	467	2304.00	89	127	NPH
241	394	2304.00	69	109	NPH	241	431	2304.00	76	117	NPH	241	468	2304.00	87	126	NPH
241	395	2304.00	68	108	NPH	241	432	2304.00	74	116	NPH	241	469	2304.00	84	125	NPH
241	396	2304.00	67	105	NPH	241	433	2304.00	72	114	NPH	241	470	2304.00	81	123	NPH
241	409	2304.00	105	136	NPH	241	434	2304.00	71	113	NPH	241	471	2304.00	80	122	NPH
241	410	2304.00	105	136	NPH	241	435	2304.00	70	111	NPH	241	472	2304.00	79	120	NPH
241	411	2304.00	105	135	NPH	241	436	2304.00	69	111	NPH	241	473	2304.00	77	119	NPH
241	412	2304.00	104	135	NPH	241	437	2304.00	67	110	NPH	241	474	2304.00	74	118	NPH
241	413	2304.00	102	135	NPH	241	438	2304.00	65	110	NPH	241	475	2304.00	73	117	NPH
241	414	2304.00	101	134	NPH	241	439	2304.00	64	108	NPH	241	476	2304.00	71	116	NPH
241	415	2304.00	100	134	NPH	241	440	2304.00	63	106	NPH	241	477	2304.00	70	114	NPH
241	416	2304.00	99	133	NPH	241	453	2304.00	103	137	NPH	241	478	2304.00	69	113	NPH
241	417	2304.00	98	133	NPH	241	454	2304.00	102	137	NPH	241	479	2304.00	67	112	NPH
241	418	2304.00	97	132	NPH	241	455	2304.00	102	137	NPH	241	480	2304.00	65	111	NPH
241	419	2304.00	94	131	NPH	241	456	2304.00	102	135	NPH	241	481	2304.00	64	111	NPH
241	420	2304.00	93	130	NPH	241	457	2304.00	100	135	NPH	241	482	2304.00	62	109	NPH
241	421	2304.00	92	129	NPH	241	458	2304.00	100	134	NPH	241	483	2304.00	62	108	NPH

ALASKA OCS REPORT DATE 03/07/79 REF NFL22C REPORT OF SELECTED OCS DATA OPTION 1

MAP #	BLK	HCTRS	RES	DEPTH	PLN	MAP #	BLK	HCTRS	RES	DEPTH	PLN	MAP #	BLK	HCTRS	RES	DEPTH	PLN
241	404	2304.00	61	127	NPH	241	553	2304.00	85	132	NPH	241	600	2304.00	80	129	NPH
241	507	2304.00	90	133	NPH	241	554	2304.00	83	131	NPH	241	601	2304.00	79	127	NPH
241	508	2304.00	89	132	NPH	241	555	2304.00	82	129	NPH	241	602	2304.00	76	124	NPH
241	509	2304.00	87	131	NPH	241	556	2304.00	81	129	NPH	241	603	2304.00	74	122	NPH
241	510	2304.00	87	129	NPH	241	557	2304.00	80	126	NPH	241	604	2304.00	71	120	NPH
241	511	2304.00	85	129	NPH	241	558	2304.00	79	125	NPH	241	605	2304.00	70	119	NPH
241	512	2304.00	83	128	NPH	241	559	2304.00	76	123	NPH	241	606	2304.00	68	118	NPH
241	513	2304.00	82	126	NPH	241	560	2304.00	73	122	NPH	241	607	2304.00	66	117	NPH
241	514	2304.00	80	124	NPH	241	561	2304.00	71	120	NPH	241	608	2304.00	65	116	NPH
241	515	2304.00	78	123	NPH	241	562	2304.00	70	118	NPH	241	609	2304.00	62	115	NPH
241	516	2304.00	76	121	NPH	241	563	2304.00	69	117	NPH	241	610	2304.00	61	114	NPH
241	517	2304.00	74	119	NPH	241	564	2304.00	67	117	NPH	241	611	2304.00	60	112	NPH
241	518	2304.00	72	118	NPH	241	565	2304.00	65	115	NPH	241	612	2304.00	59	112	NPH
241	519	2304.00	70	117	NPH	241	566	2304.00	63	114	NPH	241	613	2304.00	57	112	NPH
241	520	2304.00	69	115	NPH	241	567	2304.00	62	112	NPH	241	614	2304.00	56	111	NPH
241	521	2304.00	68	114	NPH	241	568	2304.00	61	110	NPH	241	615	2304.00	55	109	NPH
241	522	2304.00	66	113	NPH	241	569	2304.00	60	110	NPH	241	616	2304.00	53	108	NPH
241	523	2304.00	64	113	NPH	241	570	2304.00	59	110	NPH	241	639	2304.00	82	135	NPH
241	524	2304.00	63	111	NPH	241	571	2304.00	57	109	NPH	241	640	2304.00	81	135	NPH
241	525	2304.00	62	110	NPH	241	572	2304.00	56	107	NPH	241	641	2304.00	80	134	NPH
241	526	2304.00	60	109	NPH	241	595	2304.00	85	134	NPH	241	642	2304.00	79	133	NPH
241	527	2304.00	60	109	NPH	241	596	2304.00	83	133	NPH	241	643	2304.00	77	132	NPH
241	528	2304.00	57	107	NPH	241	597	2304.00	82	133	NPH	241	644	2304.00	76	130	NPH
241	551	2304.00	88	134	NPH	241	598	2304.00	81	132	NPH	241	645	2304.00	75	127	NPH
241	552	2304.00	86	133	NPH	241	599	2304.00	80	130	NPH	241	646	2304.00	73	125	NPH

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ALASKA OCS REPORT DATE 03/07/80 PGM PKL220 REPORT OF SELECTED OCS DATA OPTION 1

MAP #	BLK	HCTRS	MFS	DEPTH	PLN	MAP #	BLK	HCTRS	MFS	DEPTH	PLN	MAP #	BLK	HCTRS	MFS	DEPTH	PLN
241	647	2304.00	71	122	NPH	241	694	2304.00	64	119	NPH	241	769	2304.00	78	141	NPH
241	648	2304.00	70	120	NPH	241	695	2304.00	61	119	NPH	241	770	2304.00	76	140	NPH
241	649	2304.00	68	119	NPH	241	696	2304.00	60	118	NPH	241	771	2304.00	75	135	NPH
241	650	2304.00	66	119	NPH	241	697	2304.00	59	117	NPH	241	772	2304.00	73	138	NPH
241	651	2304.00	64	118	NPH	241	698	2304.00	57	116	NPH	241	808	2304.00	80	148	NPH
241	652	2304.00	62	117	NPH	241	699	2304.00	55	115	NPH	241	809	2304.00	80	146	NPH
241	653	2304.00	60	116	NPH	241	700	2304.00	53	114	NPH	241	810	2304.00	80	144	NPH
241	654	2304.00	60	116	NPH	241	701	2304.00	52	113	NPH	241	811	2304.00	80	143	NPH
241	655	2304.00	58	114	NPH	241	702	2304.00	50	111	NPH	241	812	2304.00	78	143	NPH
241	656	2304.00	56	114	NPH	241	703	2304.00	50	110	NPH	241	813	2304.00	76	143	NPH
241	657	2304.00	54	112	NPH	241	704	2304.00	50	109	NPH	241	814	2304.00	74	142	NPH
241	658	2304.00	53	111	NPH	241	720	2304.00	86	144	NPH	241	815	2304.00	72	140	NPH
241	659	2304.00	52	110	NPH	241	721	2304.00	85	142	NPH	241	816	2304.00	71	138	NPH
241	660	2304.00	51	108	NPH	241	722	2304.00	85	142	NPH	241	852	2304.00	78	150	NPH
241	683	2304.00	80	136	NPH	241	723	2304.00	83	141	NPH	241	853	2304.00	78	145	NPH
241	684	2304.00	79	136	NPH	241	724	2304.00	82	140	NPH	241	854	2304.00	78	146	NPH
241	685	2304.00	78	135	NPH	241	725	2304.00	80	139	NPH	241	855	2304.00	77	145	NPH
241	686	2304.00	76	134	NPH	241	726	2304.00	80	139	NPH	241	856	2304.00	75	144	NPH
241	687	2304.00	75	132	NPH	241	727	2304.00	78	138	NPH	241	857	2304.00	73	144	NPH
241	688	2304.00	73	130	NPH	241	728	2304.00	76	137	NPH	241	858	2304.00	72	143	NPH
241	689	2304.00	72	127	NPH	241	764	2304.00	82	145	NPH	241	874	2304.00	40	115	NPH
241	690	2304.00	71	126	NPH	241	765	2304.00	82	143	NPH	241	875	2304.00	45	118	NPH
241	691	2304.00	70	124	NPH	241	766	2304.00	82	143	NPH	241	876	2304.00	43	110	NPH
241	692	2304.00	68	122	NPH	241	767	2304.00	81	143	NPH	241	877	2304.00	42	114	NPH
241	693	2304.00	66	121	NPH	241	768	2304.00	80	142	NPH	241	897	2304.00	75	150	NPH.

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ALASKA OCS   REPORT DATE 03/07/80   PGM RPT22C   'REPORT OF SELECTED OCS DATA'   OPTION 1
 MAP #  BLK   HCTRS   PFS DEPTH  PLN     MAP #  BLK   HCTRS   PFS DEPTH  PLN     MAP #  BLK   HCTRS   PFS DEPTH  PLN
  241   898  2304.00  74   148   NPH      241  1033  2304.00  48   128   NPI      338   521  2304.00  52   128  7N75
  241   899  2304.00  73   147   NPH      241  1034  2304.00  47   126   NPH      338   522  2304.00  55   127  8N75
  241   900  2304.00  72   146   NPH      241  1035  2304.00  43   124   NPI      338   523  1165.00  58   127  8N75
  241   901  2304.00  70   145   NPH      241  1036  2304.00  40   122   NPH      347   358   862.83  57   107   NPH
  241   902  2304.00  70   144   NPH      241  1037  2304.00  40   119   NPI      347   359  2304.00  60   107   NPH
  241   915  2304.00  51   124   NPH      241  1063  2304.00  38   117   NPH      347   360  2304.00  62   107   NPH
  241   916  2304.00  50   123   NPH      241  1064  2304.00  35   115   NPI      347   361  2304.00  66   107   NPH
  241   917  2304.00  48   121   NPH      338   341  2304.00  40   109  7N75      347   362  2304.00  70   105   NPH
  241   918  2304.00  45   117   NPH      338   342  2304.00  42   108  7N75      347   363  2304.00  72   106   NPH
  241   919  2304.00  43   117   NPH      338   385  2304.00  39   112  7N75      347   402   963.60  57   110   NPH
  241   920  2304.00  41   116   NPH      338   386  2304.00  42   111  7N75      347   403  2304.00  59   109   NPH
  241   921  2304.00  40   115   NPH      338   387  2304.00  45   111  7N75      347   404  2304.00  62   109   NPH
  241   941  2304.00  72   154   NPH      338   388  2304.00  48   110  8N75      347   405  2304.00  65   107   NPH
  241   942  2304.00  71   152   NPH      338   389  2304.00  51   108  9N75      347   406  2304.00  69   106   NPH
  241   943  2304.00  71   149   NPH      338   390  2304.00  54   109  9N75      347   407  2304.00  73   107   NPH
  241   944  2304.00  70   148   NPH      338   391   862.13  57   108  9N75      347   408  2304.00  77   106   NPH
  241   945  2304.00  69   146   NPH      338   431  2304.00  46   115  7N75      347   446  1064.37  57   114   NPH
  241   946  2304.00  67   145   NPH      338   432  2304.00  49   115  7N75      347   447  2304.00  59   113   NPH
  241   959  2304.00  50   125   NPH      338   433  2304.00  52   114  9N75      347   448  2304.00  61   112   NPH
  241   960  2304.00  46   124   NPH      338   434  2304.00  55   110  9N75      347   449  2304.00  65   110   NPH
  241   961  2304.00  46   122   NPH      338   435   963.60  57   112  9N75      347   450  2304.00  69    98   NPH
  241   962  2304.00  44   118   NPH      338   476  2304.00  49   119  7N75      347   451  2304.00  72    99   NPH
  241   963  2304.00  41   111   NPH      338   477  2304.00  52   118  9N75      347   452  2304.00  76    98   NPH
  241   964  2304.00  40   117   NPH      338   478  2304.00  55   120  9N75      347   453  2304.00  79    95   NPH
  241   965  2304.00  38   115   NPH      338   479  1064.37  56   120  9N75      347   490  1165.00  57   121   NPH
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ALASKA OCS REPORT DATE 03/07/80 FOR [illegible] REPORT OF SELECTED OCS DATA OPTION 1

MAP #	BLK	HCTRS	PFS	DEPTH	PLH	MAP #	BLK	HCTRS	PFS	DEPTH	PLH	MAP #	BLK	HCTRS	PFS	DEPTH	PLH
347	491	2304.00	59	120	NPH	347	586	2304.00	82	114	NPH	347	712	2304.00	65	137	NPH
347	492	2304.00	61	119	NPH	347	622	1466.72	56	139	NPH	347	713	2304.00	68	135	NPH
347	493	2304.00	65	116	NPH	347	623	2304.00	60	137	NPH	347	714	2304.00	70	133	NPH
347	494	2304.00	69	113	NPH	347	624	2304.00	63	136	NPH	347	715	2304.00	73	131	NPH
347	495	2304.00	72	112	NPH	347	625	2304.00	67	134	NPH	347	716	2304.00	77	130	NPH
347	496	2304.00	75	112	NPH	347	626	2304.00	69	130	NPH	347	717	2304.00	79	129	NPH
347	497	2304.00	78	111	NPH	347	627	2304.00	72	127	NPH	347	718	2304.00	81	127	NPH
347	498	2304.00	82	111	NPH	347	628	2304.00	76	123	NPH	347	719	2304.00	84	125	NPH
347	534	1205.62	57	130	NPH	347	629	2304.00	79	120	NPH	347	720	2304.00	88	123	NPH
347	535	2304.00	59	130	NPH	347	630	2304.00	81	119	NPH	347	721	2304.00	91	121	NPH
347	536	2304.00	62	128	NPH	347	631	2304.00	83	118	NPH	347	754	1767.99	61	142	NPH
347	537	2304.00	65	125	NPH	347	666	1567.12	59	140	NPH	347	755	2304.00	64	139	NPH
347	538	2304.00	69	120	NPH	347	667	2304.00	61	139	NPH	347	756	2304.00	67	137	NPH
347	539	2304.00	72	116	NPH	347	668	2304.00	64	137	NPH	347	757	2304.00	69	135	NPH
347	540	2304.00	75	116	NPH	347	669	2304.00	67	135	NPH	347	758	2304.00	70	133	NPH
347	541	2304.00	79	115	NPH	347	670	2304.00	70	132	NPH	347	759	2304.00	73	132	NPH
347	542	2304.00	82	113	NPH	347	671	2304.00	72	129	NPH	347	760	2304.00	77	131	NPH
347	578	1366.20	57	136	NPH	347	672	2304.00	75	127	NPH	347	761	2304.00	80	131	NPH
347	579	2304.00	59	135	NPH	347	673	2304.00	79	124	NPH	347	762	2304.00	83	130	NPH
347	580	2304.00	62	133	NPH	347	674	2304.00	81	123	NPH	347	763	2304.00	85	128	NPH
347	581	2304.00	66	130	NPH	347	675	2304.00	84	122	NPH	347	764	2304.00	88	126	NPH
347	582	2304.00	69	125	NPH	347	676	2304.00	87	120	NPH	347	765	2304.00	91	124	NPH
347	583	2304.00	72	123	NPH	347	677	2304.00	[illegible]	118	NPH	347	798	1868.31	63	142	NPH
347	584	2304.00	75	122	NPH	347	710	1667.51	60	142	NPH	347	799	2304.00	65	140	NPH
347	585	2304.00	79	119	NPH	347	711	2304.00	62	139	NPH	347	800	2304.00	68	137	NPH

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  ALASKA OCS   REPORT DATE 03/07/80   FOR PR0270    REPORT OF SELECTED OCS DATA     OPTION 1
 MAP #   BLK    HCTRS   MFS  DEPTH   PLN       MAP #   BLK    HCTRS   MFS  DEPTH   PLN       MAP #   BLK    HCTRS  MFS  DEPTH   PLN
  347    801  2304.00   70    135    NPH        347    933  2304.00   93    135    NPH
  347    802  2304.00   72    134    NPH        347    934  2304.00   86    134    NPH
  347    803  2304.00   75    134    NPH        347    939  2304.00   87    134    NPH
  347    804  2304.00   78    133    NPH        347    982  2304.00   80    134    NPH
  347    805  2304.00   80    133    NPH           479 BLOCKS   1,088,137.14 HECTARES
  347    806  2304.00   83    132    NPH
  347    807  2304.00   87    130    NPH
  347    808  2304.00   85    128    NPH
  347    809  2304.00   92    126    NPH
  347    843  2304.00   67    137    NPH
  347    844  2304.00   70    136    NPH
  347    845  2304.00   72    135    NPH
  347    846  2304.00   74    136    NPH
  347    847  2304.00   77    136    NPH
  347    848  2304.00   79    136    NPH
  347    849  2304.00   81    135    NPH
  347    850  2304.00   83    135    NPH
  347    851  2304.00   87    133    NPH
  347    852  2304.00   90    131    NPH
  347    853  2304.00   93    129    NPH
  347    888  2304.00   70    134    NPH
  347    889  2304.00   72    135    NPH
  347    890  2304.00   70    135    NPH
  347    891  2304.00   70    135    NPH
  347    892  2304.00   86    135    NPH
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485

BEST DOCUMENT AVAILABLE

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ALASKA OCS  REPORT DATE 03/17/80   PGM OFC22C    REPORT OF SELECTED OCS DATA     OPTION
   479 BLOCKS   1,088,127.14 HECTARES
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APPENDIX B

SUMMARY OF MINIMUM AND MAXIMUM IMPACTS

Prepared by
The Alaska OCS Office

Summary of Minimum and Maximum Impacts

The environmental impacts from proposed lease sale 70 are based on the mean case, which represents a middle ground in the range of potentially recoverable oil and gas resources estimated for the proposed lease sale area. The minimum and maximum cases are the extremes of the resource estimate range. Potentially recoverable resources (total production of the field) are estimated to range from 240 to 3040 million barrels of oil and from 1.48 to 8.8 trillion cubic feet of gas. The following summarizes the possible environmental impacts for major issues that could derive from the minimum and maximum cases, based on the respective quantities of potentially recoverable resources.

A. Minimum Case:

1. Impacts on Fisheries: Reduced exploration efforts which curtails a proportionate reduction in probability of oil pollution and damage to fisheries resources. The risk potential, however, is already insignificant, no appreciable further reduction is likely. Resource potential will remain unaffected and developing fisheries off the Pribilof Islands will continue without additional impacts on these resources.

2. Impacts on Commercial Fishing: Under the minimum case, commercial fishing gear losses (crab gear and trawl gear), vessel collisions with offshore structures or OCS-related vessels, possible pipeline damage from trawling, and competition for labor and materials between the fishing and petroleum industries would be reduced compared to the mean case.

3. Impacts on Marine and Coastal Birds: The substantial reduction in projected hydrocarbon deposits probably would result in lower probability of significant impacts on marine and coastal birds and their habitats from oilspills and disturbance than described for the proposal (mean case). Short-term localized effects could occur in the event of an oilspill or rookery disturbance during critical periods, especially near the Pribilof Islands or in Unimak Pass or coastal lagoons. Overall, however, significant impacts on local or regional populations would remain unlikely.

4. Impacts on Marine Mammals: Since spill rate and volume of oil transported accompanying the projected reduction in hydrocarbon deposits presumably would be less than described for the mean case, overall impacts on marine mammals from direct and indirect effects of oilspills or disturbance would probably be unlikely. Short-term localized effects could occur in the event of an oilspill or rookery disturbance during critical periods. Regardless of the absolute level of resource estimates, oilspills in the area from Unimak Pass to the Pribilof Islands may pose a severe threat if they occur during migration or other periods of heavy use.

5. Impacts on Endangered Species and Non-Endangered Cetaceans: Overall impacts on endangered species from direct and indirect effects of oilspills or disturbance associated with development and transport of extracted oil would probably be less than described for the mean case, since spill rates and volume of oil transported would be reduced. Short-term localized effects could occur, however, in the event of an oilspill. However, dependent on the oil transportation mode, oilspill risks and potential direct effects on cetaceans occurring in important migratory corridors such as Unimak Pass may be a high or higher probability than would be incurred for larger discoveries of oil.

6. Impacts on Population, Subsistence, Fishing Village Livelihood, and Sociocultural Systems: Impacts on population, subsistence, fishing village livelihood, and sociocultural systems from the minimum case should be comparable to Alternative VI in population effects (representing approximately 50 percent the population of the proposal) and reduced approximately 80 percent from the proposal in the potential for oilspill effects.

7. Impacts on Community Infrastructure: Impacts associated with the minimum case could resemble the forecasts for Alternative VI, the Pribilof Islands and Unimak Pass deletions (Refer to the discussion of Alternative VI in Sec. IV.G.2.e.).

8. Impacts on Cultural Resources: Under the minimum case, the impacts on marine cultural resources would be changed to very unlikely, since fewer wells would be drilled. The population-related impact onshore, such as accidental interaction with resources and looting, would be reduced to very unlikely.

9. Impacts on State, Regional, and Local Economies: Economic impacts of proposed sale 70 on areas of Alaska other than the Aleutian Islands Census Division in which the proposed development would occur would likely be minor and are therefore not discussed in this DEIS. Overall employment impacts in the Aleutian Islands Census Division resulting from the minimum case would be roughly one-fourth as great as those indicated in Tables IV.B.4.b.-1 through IV.B.4.b.-4.

10. Impacts on Transportation Systems: Under the minimum case, impacts on the transportation systems of the subject area would be substantially reduced from those described for the mean case. Air and boat traffic could be reduced by more than 50 percent. This would be particularly true of tanker traffic as the reduction in resources under the minimum case could result in the reinjection rather than tankerage of produced natural gas.

11. Impacts on Coastal Zone Management: Impacts associated with the minimum case could be comparable to Alternative VI impacts.

B. Maximum Case:

1. Impacts on Fisheries: If the maximum case were realized, the impacts discussed for the proposal (Sec. IV.B.1.a.) would be magnified such that insignificant impacts on bottomfish, shellfish, and salmon might become significant. Of the three groups, shellfish, primarily king crab and korean horsehair crab, could be adversely impacted to the greatest extent, this by increased probability of oil pollution reaching nursing areas of larval crab concentrations. While the proposal and considered alternatives indicate zero probability of oilspills contacting Alaska Peninsula king crab nursery areas, increased production increases oilspill risk probability such that the resource could be impacted.

2. Impacts on Commercial Fishing: With expanded oil industry operations in the proposed sale area, conflicts with commercial fishing described for the proposal (Sec. IV.B.1.a.) would increase. Probably the most significant impact would be the loss of fixed fishing gear, i.e., crab pots. With greater oil production, oilspill risks would be increased such that gear and/or catch may be destroyed through contact with oil.

The maximum case would result in significant stress to onshore facilities in the area, particularly harbors and other facilities, causing competition for space and materials which could preclude fish processing, vessel anchorage, and supplies for the fishing industry. These impacts would be above the levels described for the proposal (mean case).

3. Impacts on Marine and Coastal Birds: The two to sevenfold increase in oil deposits projected for the maximum case presumably would increase the incidence of oilspills and disturbance resulting in significantly higher overall impacts on marine and coastal birds than the mean case. Significantly increased frequency of oilspills contacting surface-feeding birds at important foraging areas, such as the Pribilof Islands vicinity or Unimak Pass, could have catastrophic long-term impacts on populations of slowly-reproducing species. Increased levels of disturbance at colonies could interfere seriously with annual productivity. Thus, for the maximum case, bird populations could be reduced significantly both locally and regionally by effects associated with higher levels of industry activity.

4. Impacts on Marine Mammals: Overall impacts on marine mammals due to increased oilspill and disturbance effects associated with the maximum case would be greater than described for the proposal (mean case). An increase in petroleum resources of this magnitude would be expected to result in substantially elevated spill contact probabilities for important marine mammal migration routes and feeding areas compared to the mean case. Such an increase could lead to long-term impacts, especially on fur seals which depend heavily on the area just west of the proposed sale area between Unimak Pass and the Pribilof Islands during migration and breeding periods. Localized changes in distributions could occur as a result of increased disturbance associated with higher levels of industry activity.

5. Impacts on Endangered Species and Non-Endangered Cetaceans: Overall impacts on endangered species and marine mammals due to direct and indirect effects of oilspills or disturbance associated with the maximum would be greater than those as described for the proposed sale (mean case). Since the maximum case assumes a little less than three times the level of petroleum resources as estimated for the mean case, a substantial increase in spill contact probabilities for major whale and marine mammal migration/feeding areas would be expected as compared to the mean case. Such an increase could possibly lead to measurable, long-term, regional effects on valuable species. Increased noise and disturbance associated with high levels of development which would be expected with the maximum case could result in more localized changes in distribution and/or density of potentially sensitive species.

6. Impacts on Population, Subsistence, Fishing Village Livelihood and Sociocultural Systems: Impacts from the maximum case on population, subsistence, fishing village livelihood, and sociocultural systems should be approximately twice the proposal from population effects and approximately three times the proposal from the potential for oilspill effects.

7. Impacts on Community Infrastructure: Under the maximum case, the increased population levels over those predicted in the proposal (Alternative I) could cause a dramatic increase in community infrastructure demands. St. Paul, Unalaska, and Cold Bay could experience an extreme housing shortage, especially during peak employment years. The potential demand for utilities

or service (water, power, fire protection, etc.) could be extremely high even when compared to the proposal. It is unlikely that the communities could provide the financing, manpower, and planning needed to meet increased housing and utility demands.

8. Impacts on Cultural Resources: Under the maximum case, there would be an increased likelihood of impacts on cultural resources due to increases in population as well as the number of wells drilled, such that significant impacts would be likely.

9. Impacts on State, Regional, and Local Economies: Economic impacts of proposed sale 70 on areas of Alaska other than the Aleutian Island Census Division in which the proposed development would occur would likely be minor, and are therefore not discussed in this DEIS. Overall employment impacts in the Aleutian Island Census Division resulting from the maximum case would be roughly two and one-half times as great as those indicated in Tables IV.B.4.b.-1 through IV.B.4.b.-4.

10. Impacts on Transportation Systems: Under this case, impacts on the transportation systems of the subject areas would be substantially greater than those forecast for the mean case. A near tripling of production wells and resources, as well as a 40 percent increase in platforms would result in expanded logistics and tankerage requirements.

11. Impacts on Coastal Zone Management: Impacts from the maximum case could be approximately twice the levels discussed in the proposal.

APPENDIX C

SUMMARY OF ARCTIC OCS OPERATING ORDERS

Prepared by
U.S. Geological Survey,
Conservation Division

Oil and Gas Operating Regulations and Proposed OCS Orders for the Bering Sea OCS

Regulations governing lease operations on the OCS are administered by the U.S. Geological Survey (USGS). These regulations are contrived in Title 30, Part 250 of the Code of Federal Regulations (CFR). These regulations will be supplemental in the Norton Sound by the OCS Orders. At the present, we have Gulf of Alaska and Arctic Orders in force. Revised Gulf of Alaska Orders were published in the Federal Register December 21, 1979, and made effective January 1, 1980. Final Arctic OCS Orders were published on February 27, 1981, and were made effective the same date. As it stands, no orders are in effect for the Bering Sea OCS area extending north of the Aleutian Chain to the Bering Sea Straits.

The requirements of the existing Gulf of Alaska, as well as the Arctic Orders, address the subfreezing conditions. The Arctic Orders also contain some requirements to address the remoteness of the area, the permafrost and hydrates that are presumed to be prevalent in the area, presence of ice in Arctic waters through most of the year, and drilling from artificial islands. While some northern parts of the Bering Sea OCS area may be similar to the Arctic OCS, some of the southern parts have conditions similar to those existing in the Lower Cook Inlet, where the Gulf of Alaska Orders apply. Most of the general requirements are the same in both of these OCS Orders. Furthermore, there are only a few additional requirements that have been incorporated specifically to address the arctic conditions. One option would be to develop a separate set of Bering Sea OCS Orders. These orders would be identical to Arctic OCS Orders, in most respects. However, USGS believes that the development and adoption of just one set of Alaska OCS Orders, that would address the special conditions prevalent in both the arctic and subarctic areas of the Alaska OCS, would be a significant step towards streamlining of OCS Orders for the Alaska Region.

The proposal to have just one set of Alaska OCS Orders will be published in the Federal Register in the near future for comments. The final Alaska OCS Order Nos. 1, 2, 3, 4, 5, 7, 8 and 12, that will be developed after a review of the comments, will be in place prior to the proposed lease sale. As it is expected that these final Alaska OCS Orders will resemble extensively in format and content with the Arctic OCS Orders, now in effect, the full text of these orders is reproduced in Appendix____ ____. Orders 6, 9, 11, 13, and 14, which are associated with the post-exploration or production phase of offshore operations, are still undergoing internal review and will be available for public comment in the future. OCS Order No. 10 concerns marine sulfur extraction and will probably not be issued for the Alaska OCS. Additional OCS Orders may be prepared and issued, or the existing orders revised, as the need occurs throughout OCS operations in Alaska. In the case of non-compliance, lessees are subject to the penalty provided for in the OCS Lands Act of 1953, as amended. A general description of

operating requirements under the proposed Arctic Orders, and their mitigatory aspects, are summarized below:

OCS Order No. 1

This order requires all platforms, drilling rigs, drilling ships, and wells to have signs of standard specifications for identification of the operator, the specific lease block of operation, and well number.

This Order also requires that all subsea objects, resulting from lease operations which could present a hazard to other users of the OCS, must be identified by navigational markings as directed by the U.S. Coast Guard District Commander. Under this provision, the potential of accidents associated with subsea production systems, "stubs", fishing gear, and ship anchors, is substantially reduced as is the possibility of an oilspill from such an accident.

This Order also requires, whenever practicable, owner's identification, as approved or prescribed by the Director, to be placed upon all materials, cable, equipment, tools, containers, and other objects which could be freed and lost overboard from rigs, platforms, or supply vessels, and are of sufficient size, or are of such a nature, that they could be expected to interfere with commercial fishing gear if dropped overboard.

The Order mitigates impacts caused by offshore drilling and completion operations, fishing anchoring, shipping, and navigation activities.

OCS Order No. 2

Order No. 2 concerns procedures for the drilling of wells. It requires the operators to file, under an approved Exploration or Development and Production Plan, a drilling application which includes information on the drilling platform or vessel, well casing, mud control, safety training of the operator's personnel, and a list describing critical drilling operations which may be performed. The Order then describes certain procedures, or equipment, to be used in each phase of the drilling operation.

Lessees will be required to submit with their Exploration Plan, and Development and Production Plans, a plan showing their capability to start drilling a relief well to control a blowout, should one occur. This will have to be acceptable to the Supervisor from a technical and timing standpoint. They must also outline plans to deal with emergency situations such as loss or disablement of drilling unit or a drilling rig, loss of or damage to support craft, or to deal with hazards unique to the site of the drilling operations; including conditions such as - solid ice cover, freeze up and breakup. These requirements should mitigate concerns about the safety of operations and also the ability of operators to start drilling a relief well(s) to control a blowout, should one occur, within a reasonable time frame.

Due to the technical complexity of the Order, not all details are included in describing its mitigatory impact. This Order requires that drilling platforms and vessels be capable of withstanding the oceanographic and meteorological conditions of the area; applications must include all pertinent data on the fitness of the platform or vessel, and each such drilling structure must be inspected by the U.S. Geological Survey (USGS) for compliance with the OCS Orders. During the period of operations, operators must collect and report oceanograhic, meteorological, and performance data. These requirements should mitigate concerns about the impact of weather, waves, sediment scour, and currents on offshore drilling units.

To mitigate concerns about suitable materials and equipment being used in the Bering Sea OCS, lessees will be required to ensure that they are suitable for operations under prolonged periods of subfreezing conditions.

Order No. 2 requires operators to conduct shallow geological hazard surveys of the well site or lease block, prior to the commencement of drilling operations. The purpose of each survey is to locate shallow gas deposits, near-surface faults, obstructions, unstable bottom areas, or other conditions which are hazardous to drilling operations.

All wells must be cased and cemented to support unconsolidated sediments and to prevent communication of fluids between the formations, or pressure changes in the well. If there are indications of improper cementing, the operator shall re-cement and run logs to insure proper sealing of the well, or take other actions as approved by the Supervisor. The casing design and setting depths are to be based on all engineering and geologic factors, including the presence or absence of hydrocarbons, potential geologic hazards, and water depths. Additional casing strings may be required if abnormal geopressures are encountered. A pressure test is required of all casing strings, except the drive or structural casing, to determine the presence of leaks or inadequate cementing. The use of a casing program as described in this Order should eliminate potential impacts of freshwater zone contamination, lost production, or the possibility of accidents caused by inadequate well control.

Operators are required to obtain directional surveys on all wells. These surveys, which are filed with the Supervisor, indicate whether the well is drilled in accordance with the planned borehole migration. These surveys also provide the information required for the "target" of a relief well in the event of a blowout.

Since permafrost and/or hydrates could be encountered while drilling, especially in the northern portions of the Bering Sea OCS, lessees will be required to design their wells and the drilling programs suitably. This will ensure safe drilling operations and reliable casing/cementing programs, thus preventing release of any hydrocarbons into the marine environment.

Blowout preventers and related pressure control equipment must be installed, used, and tested in a manner necessary to insure positive well control. A specific number of these preventers must be used in every well, and they must be equipped with dual control systems. The blowout preventers and related control equipment shall be adequately protected to ensure reliable operation under existing weather conditions. Special requirements are included for floating drilling operations which necessitate the placement of the blowout preventer stack on the seafloor. These devices provide protection against oilspills resulting from a loss of well control.

There are specific requirements for the use and testing of drilling muds. Drilling muds have a number of critical functions, one of the most important being the control of subsurface pressures and the prevention of gaseous and liquid influxes into the wellbore. Drilling mud programs must be approved prior to the commencement of drilling. The operator must, at all times, maintain sufficient and readily accessible quantities of mud to insure well control. Drilling operations shall be suspended in the absence of minimum quantities of mud material specified, or as modified in the approved Plan.

Lessees will be required to ensure that all enclosed mud handling areas, where dangerous concentrations of combustible gases may accumulate, are equipped with a ventilation system, with gas monitors and electrical equipment of the "explosion proof" type. This will ensure safety in the mud handling areas which will be enclosed in the colder environment of the Bering Sea OCS.

Representatives of the operator must provide on-site supervision of drilling operations around the clock. A member of the drilling crew, or the Tool Pusher, must maintain surveillance of the rig floor continuously from the time drilling operations commence until the well is secured with blowout preventers, bridge plugs, storm packer, or cement plugs. Lessee and drilling contractor personnel shall be trained and qualified in present-day methods of well control, and records of the training are to be kept at the well site. Specific well control training requirements are outlined in U.S. Geological Survey OCS Standard No. T1 (GSS-OCS-T1). The training requirements are intended to minimize the potential for well blowouts caused by human error. Formal training is supplemented with weekly blowout-prevention exercises for all rig personnel. Drills are frequently witnessed by USGS representatives and must always be recorded in the Driller's log.

Procedures to be followed when drilling operations may penetrate reservoirs known or expected to contain hydrogen sulfide (H_2S), or in areas where the presence of H_2S is unknown, are included in U.S. Geological Survey OCS Standard No. 1 (GSS-OCS-1), "Safety Requirements for Drilling Operations in a Hydrogen Sulfide Environment." This set of standard operating procedures will assure proper equipment testing, and crew training, should highly toxic H_2S be encountered. Hazards of H_2S are substantially reduced by the institution of these procedures.

Since some operations performed in drilling are considered more critical than others with respect to well control, and for the prevention of fire, explosions, oilspills, and other discharges and emissions, each lessee must file a Critical Operations and Curtailment Plan for the Supervisor's approval.

This Order includes a requirement for listing and describing of critical operations that are likely to be conducted on the lease. Before exceeding the operational limits of an approved plan, the operator must notify the Supervisor and curtail operations. This allows the USGS to provide either specific approval in advance of the conduct of the critical operation, or to dispatch personnel to the lease site for observation of the operation. This part of OCS Order No. 2 provides additional regulatory review of drilling operations which may be hazardous to the drilling platform, vessel, crew, and the environment.

Order No. 2 also requires that when sufficient geological and engineering information is obtianed as a result of drilling operations, the lessee may make an application, or the Supervisor may require an application, for the establishment of field drilling rules. After field drilling rules have been established by the Supervisor, development wells shall be drilled in accordance with these rules, and the requirements of this Order, which are not affected by such rules.

In accordance with Section 21 of the OCS Lands Act Amendment (OCSLAA) of 1978, this Order requires the use of the Best Available and Safest Technologies (BAST). (This is discussed in the analysis of Order 5.)

OCS Order No. 3

This Order relates to the plugging and abandonment of wells. For permanent abandonment of wells, cement plugs must be placed so as to extend above the top, and below the bottom, of freshwater and oil or gas zones to prevent those fluids from escaping into other strata. Portions of a well in which abnormal pressures are encountered are also required to be isolated with cement plugs. Plugs are required at the bottom of the deepest casing where an uncased hole exists below. Plugs or cement retainers are required to be placed above and below any perforated interval of the well hole used for production of oil and gas. If casing is cut and recovered, the casing stub shall be plugged.

Any annular space communicating with any open hole and extending to the ocean floor shall be plugged with cement. A surface plug at least 45 meters (148 feet) in length, with the top of the plug 45 meters (148 feet) or less below the ocean floor, shall be placed in the smallest string of casing which extends to the ocean floor.

The setting and location of the first plug below the surface casing shall be verified by either placing a minimum pipe weight on top of the plug or by pressure testing it with a designated minimum pump pressure. The space between the plugs must be filled with drilling mud of sufficient density to exceed the greatest formation pressure encountered in drilling the interval.

The casing and piling on the seafloor must be removed to a depth below the ocean floor, as approved by the Supervisor. For temporary abandonments, all plugs and mud, discussed above, must be placed in the well with the exception of the surface plug. (The temporarily abandoned well would have to be marked in accordance with Order No. 1.)

Due to the possibility of occurrence of subsea permafrost in the northern portions of the Bering Sea OCS, the leesees will be required to ensure that the fluids left in the hole adjacent to permafrost zones have a freezing point below the temperature of the permafrost zone in order to prevent possible casing damage due to internal freezeback. In addition, these fluids will have to be treated to minimize corrosion of the casing. These measures will mitigate concern about integrity of the well being damaged, subsequent to abandonment because of permafrost, which could cause leakage of well fluids into marine environment.

This Order should eliminate concern about contamination of freshwater zones or the possibility of oil and gas leaks from abandoned wells. The requirements that the seafloor above each final abandonment must be cleared, and that the removal depth of casing and piling must be examined on a case-by-case basis, will provide protection to navigation and fishery interest. The chance that obstructions might become exposed due to changes in bottom conditions is reduced as well.

OCS Order No. 4

Order No. 4 provides for the extension of a lease beyond its primary term for as long as oil or gas may be produced in paying quantities and the lessee has met the requirements for diligent development. If these circumstances should occur, a lease can be extended beyond its initial term pursuant to the authority prescribed in 30 CFR 250.10 and 250.11, and in accordance with 30 CFR 250.12.

In addition to a production test for oil, one of similar duration is required for gas. All pertinent engineering, geologic, and economic data are required to support a claim that a well is capable of being produced in commercial quantities. Each test must be witnessed by the USGS although, with prior approval, an operator affidavit and third party test results may be acceptable. When the District Supervisor determines that open hole evaluation data, such as wireline formation tests, drill stem tests, core data, and logs, have been demonstrated as reliable in a geologic area, such data may be considered as acceptable evidence that a well is capable of producing in paying quantities. The primary purpose of this Order is to provide for determinations of well productivity which may permit extensions of lease terms. Such extensions are frequently necessary to insure the orderly development of OCS oil and gas resources.

Order No. 5

This Order sets forth requirements for the installation, design, testing, operation, and removal of subsurface safety devices. Due to the technical complexity of the Order, not all details are included in describing its mitigatory impact. In accordance with Section 21 of the OCSLAA of 1978, this Order requires the use of BAST. The lessee is encouraged to continue the development of safety-system technology. As research and product improvement results in increased effectiveness of existing safety equipment or the development of new equipment systems, such equipment may be used, and if such technologies provide a significant cost effective incremental benefit to safety, health, or the environment, shall be required to be used if determined to be BAST. Conformance to the standards, codes, and practices referenced in this Order, will be considered to be the application of BAST. Specific equipment, and procedures or systems not covered by standards, codes, or practices, will be analyzed to determine if the failure of such would have a significant effect on safety, health, or the environment. If such are identified, and until specific performance standards are developed or endorsed by the USGS, the lessee shall submit such information necessary to indicate the use of BAST, the alternatives considered to the specific equipment or procedures, and the rationale why one alternative technology was considered in place of another. This analysis shall include a discussion of the cost involved in the use of such technology and the incremental benefits gained.

This Order requires that Safety and Pollution-Prevention Equipment (SPPE) shall conform to the following quality assurance standards or subsequent revisions which the Chief, Conservation Division, USGS, has approved for use.

a. American National Standards Institute/American Society of Mechanical Engineers Standard "Quality Assurance and Certification of Safety and Pollution Preventional Equipment Used in Offshore Oil and Gas Operations", ANSI/ASME SPPE-1-1977, December 1977, (formerly ANSI/ASME-OCS-1-1977).

b. American National Standards Institute/American Society of Mechanical Engineers Standard "Accreditation of Testing Laboratories for Safety and Pollution Prevention Equipment Used in Offshore Oil and Gas Operations", ANSI/ASME-SPPE-2-1977, December 1977, (formerly ANSI/ASME-OCS-2-1977).

This Order requires that all well tubing installations, open to hydrocarbon-bearing zones, shall be equipped with a subsurface-safety device such as a Surface-Controlled Subsurface-Safety Valve (SCSSV), a Subsurface-Controlled Subsurface-Safety Valve (SSCSV), and injection valve, a tubing plug, or a tubular/annular subsurface-safety device unless, after application and justification, the well is determined to be incapable of flowing.

The lessee shall furnish evidence that the surface-controlled subsurface-safety devices and related equipment are capable of normal operation under subfreezing conditions. The surface controls may be located at a remote location.

These surface and subsurface safety valves, shall conform to "American Petroleum Institute (API) Specification for Subsurface-Safety Valves", API Spec 14A, Fourth Edition, November 1979, or subsequent revisions which the Chief, Conservation Division, has approved for use at the time of installation.

Testing or checking of these devices must be done at specified intervals. If a device does not operate correctly, it must be promptly removed and a properly operating device must be put in place and tested. Additionally, all tubing installations open to hydrocarbon-bearing zones and capable of flowing in which the subsurface-safety device has been removed, in accordance with the provisions of this Order, shall be identified by a sign on the wellhead stating that the subsurface-safety device has been removed. A subsurface-safety device shall be available for each well on the platform. In the event of an emergency, such as an impending storm, this device shall be properly installed as soon as possible with due consideration being given to personnel safety.

The subsurface-safety valves prescribed in this Order serve as a mechanism for automatically shutting in a well below the ocean floor in the event of an accident, or natural event, which destroys, or threatens to destroy, surface well control equipment. The reliability of such devices is maximized through regular testing. As a result of these requirements, the probability of a producible well blowout is minimized.

Proposed Order No. 5 also sets forth requirements for the design, installation, operation, and testing of safety systems for platform production facilities. All new platforms resulting from this sale will have to be in conformance with API RP 14C, "Analysis, Design, Installation, and Testing of Basic Surface Safety Systems on Offshore Production Platforms."

Prior to the installation of platform equipment, the lessees must submit, for the District Supervisor's approval, schematic diagrams with equipment, pipeing, firefighting, electrical-system, gas-detection, and safety-shutdown specifications. A Safety Analysis Function Evaluation Chart must also be submitted. This chart relates all sensing devices, shutdown devices, and emergency-support systems to their functions. The chart provides a means of verifying the design logic of the basic safety system.

This Order requires additional safety and pollution control requirements which modify or are in addition to those contained in API RP 14C for operation of pressure vessels, flowlines, pressure senors, emergency shutdown systems, engine exhaust systems, glycol dehydration units, gas compressors, fire fighting systems, fire and gas detection systems, electrical equipment, and erosion detection and measurement equipment.

Whenever operators plan to conduct activities simultaneously with production operations, which could increase the possibility of occurrence of an undesirable event, a "General Plan for Conducting Simultaneous Operations" in a producing field must be filed for the Supervisor's approval. Activities required in the Plan include drilling, workover, wireline, pumpdown, and major construction operations. The intent of this requirement is to permit USGS review of the conduct, control, and coordination of the proposed operations. This review will determine whether the operations can be conducted simultaneously without significantly increasing the risk of accidents or spills.

Prior to welding or burning operations, lessees must submit a plan describing personnel requirements and designating safe welding areas. Procedures for establishing safe welding areas, and for conducting operations outside such areas, are specified in this Order. The requirements reduce the potential for explosions, injuries, and pollution discharges.

This Order also requires the lessees to maintain records, for a minimum period of 5 years, for each surface-safety device installed. These records shall be available for review by any authorized representative of the USGS. The records shall show the present status and history of each device, including dates and details of installation, inspection, testing, repairing, adjustments, and re-installation.

As per USGS's Failure and Inventory Reporting System (FIRS), which applies to offshore structures, including satellites and jackets, which produce or process hydrocarbons and includes the attendant portions of hydrocarbon pipelines, when physically located on the structure. When the devices specified are used as a part of the production safety and pollution prevention system, this Order requires the lessee to:

a. Submit an initial inventory of the safety and pollution prevention devices with periodic updates.

b. Report all device failures which occur.

To mitigate the potential for accidents resulting from human error, all personnel engaged in installing, inspecting, testing, and maintaining safety devices must meet specific training requirements. This Order also sets forth requirements for employee orientation and motivation programs concerned with safety and pollution prevention in offshore oil and gas operations.

OCS Order No. 7

Order No. 7 relates to the prevention of pollution to the marine environment and provides rules for the disposal of waste materials generated as a result of offshore operations in a manner which will not "adverrely affect the public health, life, property, aquatic life, wildlife, recreation, navigation, commercial fishing, or other uses of the ocean."

The operators must submit a list of drilling mud constituents, additives, and concentrations expected to be used; this provides a means to evaluate or alter the use and/or disposal of specific components which might be harmful to the environment. The disposal of drilling mud and drill cuttings, sand, and other well solids, including those containing oil, is subject to the Environmental Protection Agency's permitting procedures, pursuant to the Federal Water Pollution Control Act, as amended. Approval of the method of drilling mud disposal into the ocean shall be obtained from the District Supervisor; each request will be decided on a case-by-case basis.

This Order requires that curbs, gutters, drip pans, and drains shall be installed in all deck areas in a manner necessary to collect all contaminants and to be piped to a properly designed, operated, and maintained sump system which will automatically maintain the oil at a level sufficient to prevent discharge of oil into OCS waters. Also, no solid waste materials or debris can be disposed of in the marine environment. Compliance with these requirements virtually eliminates the potential for adverse impacts on the biological communities, water quality, commercial fisheries, and offshore recreation, and also mitigates impacts along the coastline which could be caused by the washing of oil, fuel, chemical residues, or toxic substances to shore.

The disposal of equipment into the sea is prohibited, except under emergency conditions. The location and description of any equipment so discharged must be reported to the Supervisor. This requirement is intended to mitigate the potential for interference with commercial fishing operations. All personnel must be thoroughly instructed in the prevention of pollution from offshore operations. Rigorous inspection schedules are required for all facilities. Pollution reports are required for all oilspills, and procedures are set forth for the notification of proper authorities. Pollution-control equipment must be maintained, or available, to each lessee. The equipment must include booms, skimmers, cleanup materials, and chemical agents. The equipment must be maintained and inspected monthly. (Chemical agents or additives for treatment of oilspills require the consent of the Supervisor in accordance with Annex X, National Oil and Hazardous Substance Pollution Contingency Plan, and in accordance with the Memorandum of Understanding (MOU) between the Department of Transportation (U.S. Coast Guard) and the Department of Interior (U.S. Geological Survey), dated August 16, 1971.)

This Order also sets forth requirements for pollution inspection of manned and unattended facilities on a daily basis or at intervals prescribed by the Supervisor. Also, it sets forth requirements for pollution reports.

Operators must submit an Oilspill Contingency Plan for approval by the Supervisor before an application to conduct drilling operations may be approved. The Plan must contain provisions for varying degrees of response effort depending on the severity of the oilspill; identification of available containment and cleanup equipment; notification of responsible persons and alternates in the event of a spill; identification of areas of special biological sensitivity; and specific actions to be taken after the discovery of an oil discharge. Should a spill occur, immediate corrective action must be taken.

Drilling and training classes for familiarization with pollution-control equipment and operational procedures must be conducted on a schedule approved by the Supervisor. The drills must include the deployment of equipment.

Although the emphasis of the OCS Orders is on the prevention of oilspills, it is recognized that spills will occur. It is also recognized that it is not technically possible to completely control and mechanically remove all oil that is discharged. The intent of this portion of the Order is to insure that the operators have ready access to the best practical control equipment for the area, and for the prevailing conditions, and that personnel are trained to effectively utilize the equipment. The operator's plans must have sufficient flexibility to permit different spill-control strategies for different environmental conditions. This provides for mechanical and chemical measures which best compliment the forces of nature and maximize the protection of biological communities, shoreline resources, and commercial interests.

OCS Order No. 8

This Order sets forth requirements for the design, installation, major modification and repairs, and verification of platforms and structures (including man-made ice and gravel islands).

The Order specifies the procedures for the Platform Verification Program, as well as the requirements for verifying the structural integrity of the OCS platforms.

All structural plans must be certified by a registered professional structural engineer or a civil engineer specializing in structural design. Verification of the design, fabrication, installation, and modifications to offshore platforms and structures, will be done by a certified verification agent who is nominated by the lessee.

The Order requires submittal of the design plan to cover design documentation, general platform information, environmental and loading information, foundation and structural information, and the design verification.

For new platforms, or other structures, and for modifications which are subject to review under the requirements of the Platform Verification Program, the lessee shall submit a Fabrication Verification Plan for new platforms or other structures, and for modifications subject to review under the requirements of the Platform Verification Program, the lessee shall submit an Installation Verification Plan subsequent to the submittal of the Fabrication Verification Plan.

Order No. 8 also requires the lessee to compile, retain, and make available for review for the functional life of the platform or other structure that is subject to the provisions of this Order, the as-built structural drawings, the design assumptions and analysis, and a summary of the Non-Destructive Examinations records.

This Order assures careful review of platform design and minimizes the possibility of spills and environmental damage resulting from structural failure.

OCS Order No. 12

This Order sets forth requirements for the public availability of data and records concerning offshore petroleum operations. As per this Order, specific types of data and records pertaining to drilling and production operations, well tests, sale of lease production, accidents, inspections, and pollution incidents, are to be available for public inspection. Privileged information, such as certain geological and geophysical data, would be made available for public inspection with the lessee's consent or after a fixed period of time has elapsed. By making operations data available, this Order permits increased public awareness of OCS activities and involvement in OCS programs. Increased public interest and understanding should result in continuing improvements in the safety and pollution-prevention programs of both industry and Government.

APPENDIX D

BIOLOGICAL OPINION ON ENDANGERED BIRDS

Requested by
The Alaska OCS Office

Prepared by
Fish and Wildlife Service

United States Department of the Interior

FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

ADDRESS ONLY THE DIRECTOR
FISH AND WILDLIFE SERVICE

In Reply Refer To:
FWS/OES BLM/GS-80-2

SEP 16 1980

Memorandum

To: Director, Bureau of Land Management
Director, U.S. Geological Survey

From: ACTING Director

Subject: Revision of August 22, 1980, Biological Opinion Regarding Outer Continental Shelf (OCS) Oil and Gas Leasing and Exploration Activities in the Bering Sea Region

Recent information from Dennis Money, Alaska Area Office, indicates that the peregrine nesting survey in the Sale #57 (Norton Basin) area of the Bering Sea cannot be accomplished for 1980. Therefore, the subject biological opinion should be amended to read as follows:

1. Page 1. Paragraph 2. Delete lines 7-12 "There is limited knowledge... formal consultation must be reinitiated."

2. Incorporate the following statements as the first paragraph on page 3.

   To assist you in exercising your authority for the conservation of listed species, the following actions are recommended:

   a. Aircraft supplying and servicing exploration activities must maintain at least 1500 feet altitude above nest level within 1 mile horizontal distance of peregrine falcon eyries identified in past surveys in the Sale #57 (Norton Basin) area. The U.S. Fish and Wildlife Service, Alaska Area Office, should be contacted to determine the location of these historical eyries.

   b. A complete updated survey delineating current peregrine nesting areas in the Sale #57 area should be completed no later than October 1981. If nesting birds are present this formal consultation must be reinitiated.

The revised biological opinion is attached.

/s/ [illegible] O'Connor

Attachment

cc: Directorate Reading File
LD Chron File - AFA File
OES Reading - OES Surname - OES Chron
FWS/OES:Lwest:mc:235-2760 8-27-80

In Reply Refer To:
FWS/OES BLM/GS-80-2

Memorandum

To: Director, Bureau of Land Management
Director, U.S. Geological Survey

From: Director

Subject: Biological Opinion Regarding Outer Continental Shelf (OCS) Oil and Gas Leasing and Exploration Activities in the Bering Sea Region

By memorandum received June 6, 1980, the Bureau of Land Management (BLM) and the U.S. Geological Survey (GS) requested a joint formal consultation on the proposed Outer Continental Shelf (OCS) oil and gas program in the Bering Sea region. Four proposed OCS lease Sales are scheduled to take place in this region between September 1982 and December 1984. This consultation considers oil and gas leasing and exploration activities in the area that encompasses proposed Sales 57 (Norton Basin), 70 (St. George Basin), 75 (Northern Aleutian Shelf), and 83 (Navarin Basin). By memorandum dated June 19, 1980, a list of four species which may be affected by the OCS programs was received from the BLM Alaska OCS Office, including the American and Arctic peregrine falcons (Falco peregrinus anatum, F. p. tundrius), short-tailed albatross (Diomedea albatrus), Aleutian Canada goose (Branta canadensis leucopareia), and Eskimo curlew (Numenius borealis).

Through informal consultation, agreement was made that the only "may affect" situation associated with the leasing and exploration activities would be for Sale #57 (Norton Basin). The effect would be possible disturbance of nesting peregrines along the coast near Nome by aircraft (primarily helicopters) supplying and servicing exploration activities. Similar work activities involving support and supply bases in Dutch Harbor, Cold Bay, and St. Paul will not adversely affect listed species or associated Critical Habitat.

Neither the short-tailed albatross nor the Eskimo curlew have been recently reported in or near the Bering Sea Sale areas. Probably the most vulnerable habitat of the Aleutian Canada goose would be Buldir Island. However, net transport of oil spills in this region would likely be northward, away from Buldir Island. In addition, large distances between Buldir Island and the lease

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Neither the short-tailed albatross nor the Eskimo curlew have been recently reported in or near the Bering Sea Sale areas. Probably the most vulnerable habitat of the Aleutian Canada goose would be Buldir Island. However, net transport of oil spills in this region would likely be northward, away from Buldir Island. In addition, large distances between Buldir Island and the lease areas would allow substantial weathering of spilled oil. Thus, there appears to be little chance of spilled oil reaching Buldir Island, the only known nesting area for the species. Therefore, the only species included in this biological opinion are the American and Arctic peregrine falcons (Falco peregrinus anatum and F. p. tundrius), for which a summary of the biological data is provided below.

American and Arctic Peregrine Falcons (Falco peregrinus anatum and F. p. tundrius)

The peregrine is a medium-sized falcon. Both of these subspecies have been listed as Endangered since 1970 and Critical Habitat for the American falcon has been designated in California.

The principal cause of the peregrine's decline has been contamination by chlorinated pesticides. Other factors contributing to their decline include shooting, predation (by great horned owls in particular), egg collecting, disease, falconers, human disturbance at nesting sites, and loss of habitat to human encroachment.

The Arctic peregrine breeds in the North American tundra, and migrates mainly along the east coast where it is the most common of the two subspecies. While a few pair of American peregrines still breed in Labrador, the Eastern U.S. population of American peregrines is considered to have been extirpated. However, as a result of the captive breeding program at Cornell University, peregrine falcons have been reintroduced in the northeastern U.S. There are indications that this reintroduction effort may be successful, and that someday breeding pairs may again occur in the eastern U.S.

During migration, coastal habitats are used extensively by peregrine falcons. Peregrines can also be found as far as 300 miles offshore during the migration period. Since they are capable of feeding while in flight, it is possible that spills which remain offshore can result in the oiling of peregrines or their prey. In addition, peregrines which rest on beaches during migration may become oiled. The probability of a spill occurring during exploration activities, however, is very remote. The expansion of existing facilities, the establishment of new facilities, or the construction of gravel islands may impact this species and will require reinitiation of consultation before a Corps of Engineers Section 10 permit can be issued.

Since nesting and migration areas are relatively distant from the project area and the potential for an oil spill resulting from exploration activities is small, it is my biological opinion that the proposed oil and gas leasing and exploration activities associated with proposed OCS Sales 57, 70, 75, and 83 are not likely to jeopardize the continued existence of the listed species considered herein, and because there is no designated Critical Habitat within or near the project area, Critical Habitat will not be affected.

To assist you in exercising your authority for the conservation of listed species, the following actions are recommended:

1. Aircraft supplying and servicing exploration activities must maintain at least 1500 feet altitude above nest level within 1 mile horizontal distance of peregrine falcon eyries identified in past surveys in the Sale #57 (Norton Basin) area. The U.S. Fish and Wildlife Service, Alaska Area Office, should be contacted to determine the location of these historical eyries.

2. A complete updated survey delineating current peregrine nesting areas in the Sale #57 area should be completed no later than October 1981. If nesting birds are present this formal consultation must be reinitiated.

Should the use or expansion of other facilities be proposed or should the initiation of activities (such as the construction of gravel islands for exploration purposes) not specifically mentioned in this consultation be proposed, reinitiation of Section 7 consultation will be required. Since development/production activities may affect listed species, Section 7 consultation will be required before this phase is entered. If a new species which may be affected should be listed, or additional pertinent information becomes available, or the project description change, Section 7 consultation must be reinitiated.

We would like to thank BLM and GS for their consideration in providing the necessary information needed to conduct this consultation.

United States Department of the Interior
FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

ADDRESS ONLY THE DIRECTOR
FISH AND WILDLIFE SERVICE

AUG 22 1980

In Reply Refer To:
FWS/OES BLM/GS-80-2

Memorandum

To: Director, Bureau of Land Management
Director, U.S. Geological Survey

Associate
From: ~~Director~~ Director

Subject: Biological Opinion Regarding Outer Continental Shelf (OCS) Oil and Gas Leasing and Exploration Activities in the Bering Sea Region

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Neither the short-tailed albatross nor the Eskimo curlew have been recently reported in or near the Bering Sea Sale areas. Probably the most vulnerable habitat of the Aleutian Canada goose would be Buldir Island. However, net transport of oil spills in this region would likely be northward, away from Buldir Island. In addition, large distances between Buldir Island and the lease areas would allow substantial weathering of spilled oil. Thus, there appears to be little chance of spilled oil reaching Buldir Island, the only known nesting area for the species. Therefore, the only species included in this biological opinion are the American and Arctic peregrine falcons (*Falco peregrinus anatum* and *F. p. tundrius*), for which a summary of the biological data is provided below.

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Should the use or expansion of other facilities be proposed or should the initiation of activities (such as the construction of gravel islands for exploration purposes) not specifically mentioned in this consultation be proposed, reinitiation of Section 7 consultation will be required. Since development/production activities may affect listed species, Section 7 consultation will be required before this phase is entered. If a new species which may be affected should be listed, or additional pertinent information becomes available, or the project description change, Section 7 consultation must be reinitiated.

We would like to thank BLM and GS for their consideration in providing the necessary information needed to conduct this consultation.

Ronald E Lambertson

APPENDIX E

OILSPILL RISK ANALYSIS

Requested by
The Alaska OCS Office

Prepared by
U.S. Geological Survey

There are three features of the USGS Oilspill Risk Analysis in this appendix which require clarification. First, the three block deletion alternatives are labeled differently than in the Draft Environmental Impact Statement (DEIS) (see also Fig. E-1):

Coding for Deletion Alternatives

USGS OSRA (this appendix) Deletion Alternative	DEIS Alternative	Description
1	IV	Pribilof deletion
2	V	Unimak deletion
3	VI	Pribilof and Unimak deletion

Secondly, the seasonal sensitivity of 11 categories of biological resources (labeled targets and impact zones in this appendix) are also considered in the analysis. For example, a resource such as migrating birds could be contacted by simulated oilspills only when the birds would be in the area. The seasonality of targets and impact zones are listed below:

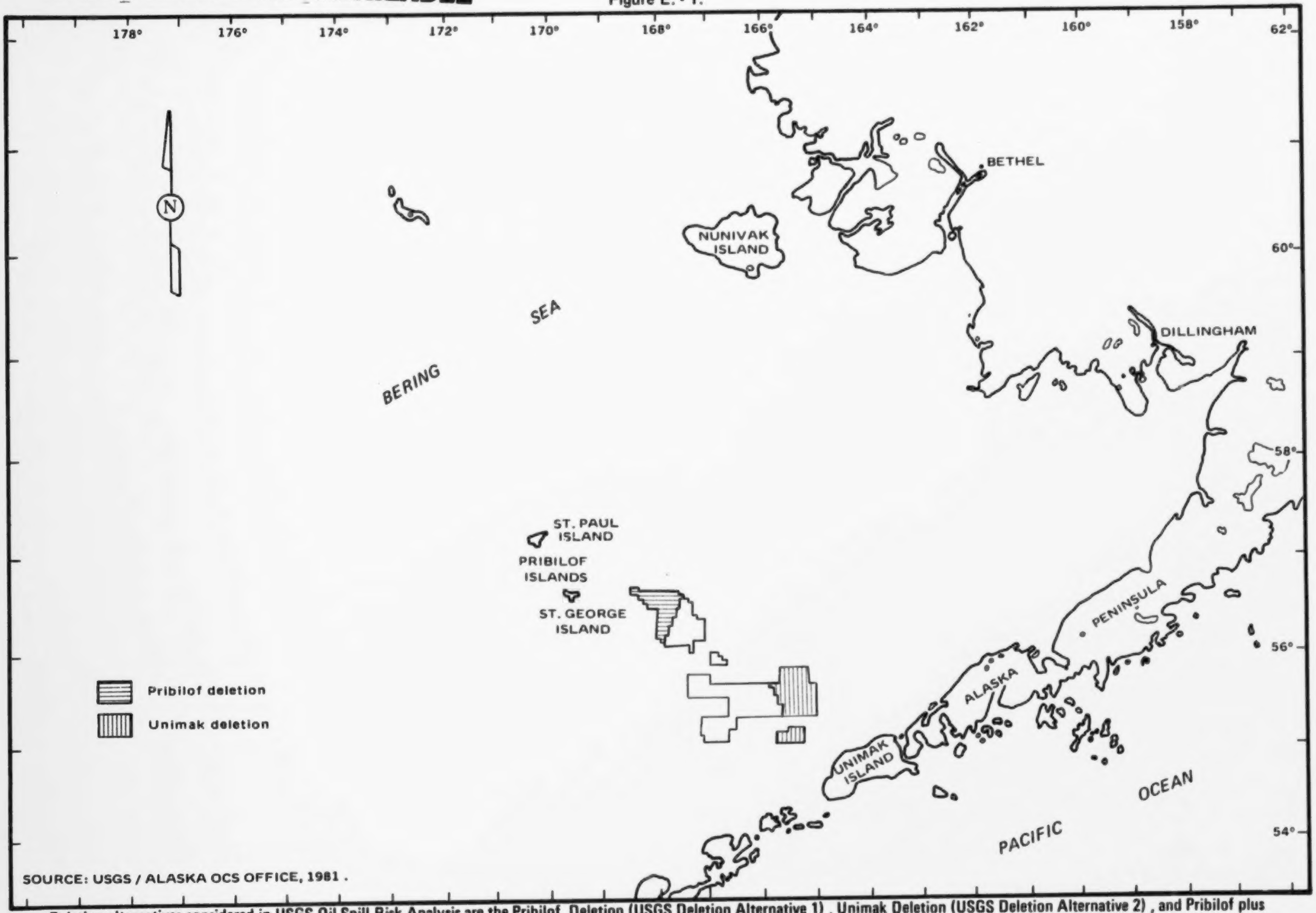
Bottomfishing area 1 (vulnerable all year)
Bottomfishing area 2 (vulnerable all year)
Bottomfishing area 3 (vulnerable all year)
Bottomfishing area 4 (vulnerable all year)
Bottomfishing area 5 (vulnerable all year)
Pollock eggs area (vulnerable March through June)
King crab area 1 (vulnerable April through May)
King crab area 2 (vulnerable April through May)
Yellowfin sole eggs area (vulnerable August to October)
Yellowfin sole eggs (high concentration) area vulnerable (August to October)
Impact zones for seabirds and marine mammals (all year)

Thirdly, the equation below has been used in the DEIS to calculate the probability that any of a group of biological resource or land/boundary targets would be contacted by an oilspill:

$$\text{probability} = 1 - (1-p_1) \times (1-p_2) \times \ldots\ldots\ (1-p_n),$$

where $(1-p_n)$ is the probability that the nth segment or resource target would not be contacted by an oilspill.

Figure E. - 1.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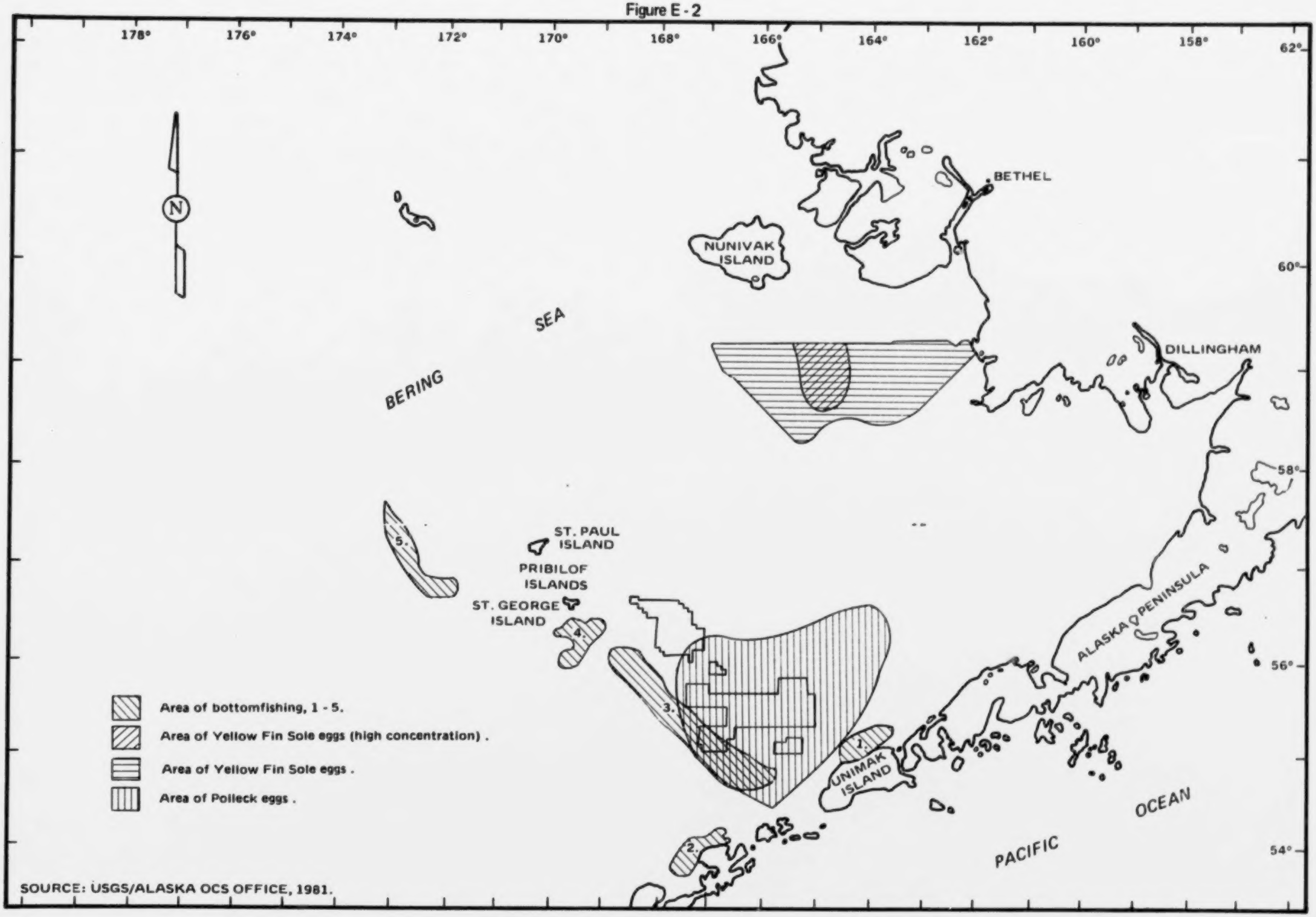
▤ Pribilof deletion
▥ Unimak deletion
ALASKA PENINSULA
UNIMAK ISLAND
PACIFIC OCEAN
SOURCE: USGS / ALASKA OCS OFFICE, 1981 .

Deletion alternatives considered in USGS Oil Spill Risk Analysis are the Pribilof Deletion (USGS Deletion Alternative 1) , Unimak Deletion (USGS Deletion Alternative 2) , and Pribilof plus Unimak Deletion (USGS Deletion Alternative 3) .

Figure E - 2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ST. GEORGE ISLAND
ALASKA PENINSULA
UNIMAK ISLAND
PACIFIC
OCEAN
1.
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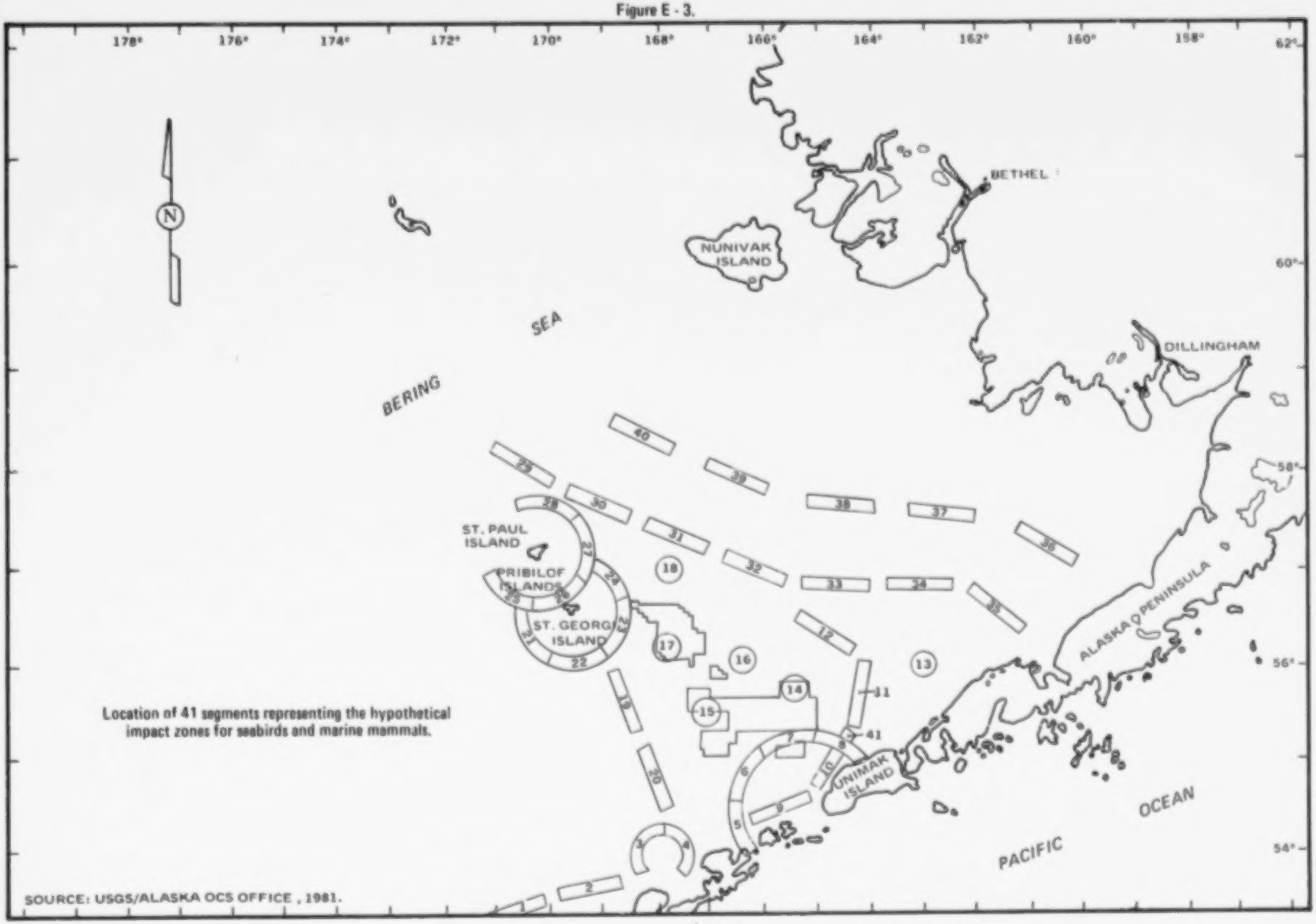
3.
4.
5.
▧ Area of bottomfishing, 1 - 5.
▨ Area of Yellow Fin Sole eggs (high concentration) .
▤ Area of Yellow Fin Sole eggs .
▥ Area of Polleck eggs .

SOURCE: USGS/ALASKA OCS OFFICE, 1981.

Figure E - 3.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Location of 41 segments representing the hypothetical impact zones for seabirds and marine mammals.

SOURCE: USGS/ALASKA OCS OFFICE , 1981.

TABLE E.1

TABLE 3. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) THAT AN OILSPILL STARTING AT A PARTICULAR LOCATION WILL CONTACT A CERTAIN TARGET WITHIN 3 DAYS.

TARGET	HYPOTHETICAL SPILL LOCATION																													
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
LAND	15	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	12	1	N	N	N
BOTTOM FISHING 1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
BOTTOM FISHING 2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	**	71	N	N	N	N
BOTTOM FISHING 3	N	N	N	N	N	N	N	N	N	N	N	N	N	10	42	N	N	N	N	N	20	**	30	11	5	N	N	N	N	N
BOTTOM FISHING 4	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
BOTTOM FISHING 5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
POLLECK EGGS AREA	N	N	N	N	N	N	N	1	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	20	2	N	N	N	N	75
KING CRAB AREA 1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
KING CRAB AREA 2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
YELLOWFIN SOLE AREA	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
YELLOWFIN SOLE (HIGH)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

NOTE: ** = GREATER THAN 99.5 PERCENT; N = LESS THAN 0.5 PERCENT.

TABLE E.2

TABLE 4. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) THAT AN OILSPILL STARTING AT A PARTICULAR LOCATION WILL CONTACT A CERTAIN TARGET WITHIN 10 DAYS.

TARGET	HYPOTHETICAL SPILL LOCATION																													
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
LAND	15	10	12	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	N	11	15	21	21	27	19	N	N	N
BOTTOM FISHING 1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2	9	2	N	15	5	1	4	N	N	N	N	N	N	N
BOTTOM FISHING 2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	5	20	**	75	N	N	N	N
BOTTOM FISHING 3	N	N	N	N	10	5	N	15	30	35	40	40	45	50	55	N	20	40	50	50	50	**	30	12	14	4	N	N	N	15
BOTTOM FISHING 4	N	N	15	15	20	15	30	10	5	15	10	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
BOTTOM FISHING 5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
POLLECK EGGS AREA	N	N	N	1	1	1	2	4	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	25	17	4	N	N	N	75
KING CRAB AREA 1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
KING CRAB AREA 2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
YELLOWFIN SOLE AREA	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	6	5	N	N
YELLOWFIN SOLE (HIGH)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

NOTE: ** = GREATER THAN 99.5 PERCENT; N = LESS THAN 0.5 PERCENT.

TABLE E.3

TABLE 5. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) THAT AN OILSPILL STARTING AT A PARTICULAR LOCATION WILL CONTACT A CERTAIN TARGET WITHIN 30 DAYS.

TARGET	HYPOTHETICAL SPILL LOCATION																													
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
LAND	52	10	10	N	6	5	5	7	10	7	7	11	15	19	21	24	29	24	29	31	30	31	45	47	39	40	52	22	10	19
BOTTOM FISHING 1	N	N	N	N	N	N	2	N	N	N	7	2	5	10	11	7	14	6	9	12	10	9	16	15	6	4	N	N	N	N
BOTTOM FISHING 2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	10	20	**	75	N	N	N	N
BOTTOM FISHING 3	N	N	N	N	10	5	N	15	35	35	40	40	45	92	95	30	50	50	50	50	50	**	30	12	16	6	N	N	N	25
BOTTOM FISHING 4	N	N	15	15	20	15	30	15	15	20	10	10	N	N	N	10	10	5	N	5	N	N	N	N	N	N	N	N	17	15
BOTTOM FISHING 5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
POLLECK EGGS AREA	N	N	1	1	1	1	2	4	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	25	19	10	N	N	N	75
KING CRAB AREA 1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
KING CRAB AREA 2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
YELLOWFIN SOLE AREA	2	1	2	2	1	2	N	1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	7	21	4	N
YELLOWFIN SOLE (HIGH)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2	10	2	N

NOTE: ** = GREATER THAN 99.5 PERCENT; N = LESS THAN 0.5 PERCENT.

TABLE E.4

TABLE 6. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) THAT AN OILSPILL STARTING AT A PARTICULAR LOCATION WILL CONTACT A CERTAIN IMPACT ZONE WITHIN 3 DAYS.

IMPACT ZONE	HYPOTHETICAL SPILL LOCATION																													
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
4	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	12	31	N	N	N	N
5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	20	N	51	45	1	N	N	N	N
6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	N	N	N	37	15	40	33	15	6	N					
7	N	N	N	N	N	N	N	N	N	N	N	N	N	2	N	N	4	2	**	55	29	N	N	N	N					
8	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	N	N	6	N	N	N	N	N					
9	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	21	**	39	1					
10	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2	N	N	1	N	N					
14	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	**	11	17	1	N	N	N	N	N	N					
15	N	N	N	N	N	N	N	N	N	N	26	30	25	25	11	N	N	N	N	N	N	N	N	N	N					
16	N	N	N	N	N	N	N	N	15	9	1	5	N	N	N	10	N	N	N	N	N	N	N	N	N	N	N	N	N	**
17	N	N	2	4	**	25	19	44	5	5	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N					
18	N	N	4	1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	25	N
23	N	16	47	30	30	15	30	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N					
24	N	31	15	15	10	N	N	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N					
26	2	34	10	5	5	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N					
27	9	N	10	5	5	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N					
31																										N	N	N	19	N
32																										N	N	N	32	N
39																										N	N	11	N	N
40																										N	N	16	N	N

NOTES: ** = GREATER THAN 99.5 PERCENT; N = LESS THAN 0.5 PERCENT.
ROWS WITH ALL VALUES LESS THAN 0.5 PERCENT ARE NOT SHOWN.

TABLE E-5

TABLE 7. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) THAT AN OILSPILL STARTING AT A PARTICULAR LOCATION WILL CONTACT A CERTAIN IMPACT ZONE WITHIN 10 DAYS.

IMPACT ZONE	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	10	N	N	N	N
3	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	N	5	30	20	N	N	N	N
4	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	20	5	25	40	31	N	N	N	N
5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	10	20	30	51	46	22	N	N	N	N
6	N	N	N	N	N	N	N	N	N	N	2	N	N	5	16	N	5	N	37	30	50	32	20	6	4	2	N	N	N	N
7	N	N	N	N	N	N	N	N	2	2	5	11	14	17	10	N	4	11	**	56	32	10	4	4	2	N	N	N	N	2
8	N	N	N	N	N	N	N	N	N	N	N	N	2	2	N	2	15	11	11	22	17	9	15	1	N					
9	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2	N	N	N	N	N	2	26	**	45	21	9	N	N	N	N
10	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2	7	7	17	20	19	26	9	N					
11	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	24	27	7	N	9	4	N	1	N	N					
12	N	N	N	N	N	N	N	N	N	N	N	1	1	N	N	20	6	4	N	N	N	N	N	N	N	N	N	N	2	9
14	N	N	N	N	N	N	N	N	6	6	1	11	20	9	5	**	12	24	14	1	4	2	1	N	N	N	N	N	N	12
15	N	N	N	N	N	N	N	N	N	N	26	30	25	25	11	15	10	25	5	5	10	N	N	N	N					
16	N	N	N	5	2	9	2	10	17	20	17	13	2	2	2	15	5	6	1	N	N	N	N	N	N	N	N	N	N	**
17	N	9	12	6	**	27	25	44	15	10	5	10	5	N	N	10	5	5	N	N	N	N	N	N	N	N	N	N	N	15
18	N	7	16	2	2	2	2	1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	25	N
19	N	N	N	N	10	10	10	20	20	30	30	20	20	15	15	N	N	N	15	N	5	N	N	N	N					
20	N	N	N	N	N	N	N	N	N	5	10	10	15	25	30	N	N	N	10	N	10	25	15	10	10	5	N	N	N	N
21	N	25	15	15	15	5	15	5	10	5	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	5
22	N	N	10	N	15	15	25	10	5	10	10	5	N	N	N	N	N	N	N	N	N	N	N	N	N					
23	5	21	47	30	40	30	36	20	5	10	5	5	N	N	N	5	N	N	N	N	N	N	N	N	N	N	N	N	5	5
24	14	32	15	15	10	5	N	5	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	20	10
25	N	15	10	5	N	N	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N					
26	5	34	15	15	10	10	10	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	20	N
27	45	2	10	10	5	5	N	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	15	5
28	4	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	N
30	10	2	1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	15	N	N
31	N	6	9	4	4	4	N	1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	19	N
32	N	N	N	2	1	6	N	1	2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	40	4
33	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	1	N	N	N	N	N	N	N	N	N	N	N	N	2	1
39																										N	N	21	4	N
40																										N	N	16	N	N
41	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	6	5	N	9	4	N	5	N	N					

NOTES: ** = GREATER THAN 99.5 PERCENT; N = LESS THAN 0.5 PERCENT.
ROWS WITH ALL VALUES LESS THAN 0.5 PERCENT ARE NOT SHOWN.

TABLE E-6

TABLE 8. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) THAT AN OILSPILL STARTING AT A PARTICULAR LOCATION WILL CONTACT A CERTAIN IMPACT ZONE WITHIN 30 DAYS.

IMPACT ZONE	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	N	N	N	N					
2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	5	5	15	10	15	10	N	N	N	N
3	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	10	10	20	15	15	30	20	N	N	N	N
4	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	10	25	20	25	40	31	N	N	N	N
5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	10	20	30	51	46	24	N	N	N	N
6	N	2	2	N	N	N	2	N	N	N	5	N	N	5	16	N	5	N	37	30	50	32	20	6	5	4	N	N	N	N
7	N	2	2	2	2	2	N	2	7	11	11	14	14	17	11	N	4	11	**	56	32	12	5	4	4	2	N	N	N	5
8	N	N	N	N	2	2	2	2	5	5	5	5	14	14	16	2	15	14	15	22	21	27	24	17	15	10	N	N	N	5
9	N	N	N	N	N	N	N	N	N	N	2	N	N	2	9	N	N	N	2	N	2	26	**	45	24	15	N	N	N	N
10	N	N	N	N	N	N	2	2	2	N	N	7	10	10	13	2	2	14	16	17	21	25	26	19	19	7	N	N	N	2
11	N	N	2	2	7	9	2	12	15	16	17	15	22	19	19	29	31	29	24	20	22	19	7	5	5	2	N	N	2	13
12	N	1	2	6	10	9	5	11	24	22	24	24	19	16	15	22	9	14	7	4	4	2	1	2	2	1	N	N	9	27
13	N	N	N	N	N	N	N	N	4	6	5	5	4	2	4	14	15	11	5	7	9	10	4	2	1	N	N	N	2	6
14	N	2	2	2	5	5	9	5	12	14	14	14	22	20	21	**	12	24	16	1	6	2	1	1	1	N	N	N	N	12
15	N	5	N	N	2	N	2	N	N	N	26	30	25	25	11	15	10	25	5	5	10	N	N	N	N					
16	2	10	9	9	9	11	10	10	17	20	20	13	2	4	4	15	5	6	1	N	N	N	N	N	N	N	N	N	N	**
17	2	14	12	6	**	27	25	44	15	10	5	10	5	N	N	10	5	5	N	N	N	N	N	N	N	N	N	N	N	15
18	7	14	17	4	4	2	2	1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	25	N
19	N	N	N	N	10	10	10	20	30	30	30	20	20	15	15	15	25	25	15	10	5	N	N	N	N	N	N	N	N	20
20	N	N	N	N	N	N	N	N	N	5	10	10	25	25	30	20	25	25	30	25	30	25	20	10	10	5	N	N	N	N
21	N	25	15	30	15	20	15	15	15	10	5	N	N	N	N	5	N	5	N	5	N	N	N	N	N	N	N	5	20	15
22	N	N	10	5	20	20	25	15	15	10	10	5	N	N	N	5	5	5	N	5	N	N	N	N	N	N	N	N	10	10
23	9	21	47	30	40	30	36	20	5	10	5	5	N	N	N	10	N	N	N	N	N	N	N	N	N	N	N	N	5	10
24	10	32	19	15	10	5	N	5	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	20	10
25	N	15	10	5	N	N	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	N	N
26	5	34	15	15	10	10	10	5	N	N	N	N	N	N	N	5	5	N	N	N	N	N	N	N	N	N	N	5	20	N
27	45	2	10	10	5	5	N	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	15	5
28	4	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	N
30	20	4	1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	15	N	N
31	19	22	12	5	4	5	2	1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	19	N
32	9	15	20	26	20	22	15	14	5	5	5	1	1	1	1	N	N	N	N	N	N	N	N	N	N	N	N	N	40	4
33	N	9	11	12	2	12	4	11	11	14	14	10	7	7	2	4	1	4	2	1	1	2	N	1	1	N	N	N	11	14
34	N	N	N	5	N	6	N	N	2	4	2	4	5	5	1	14	7	7	2	1	1	N	1	N	N	N	N	5	4	4
35	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	4	4	N	N	2	1	N	1	N	N					
37	N	N	N	N	N	1	N	N	1	1	1	N	N	N	N	1	1	N	N	N	N	N	N	N	N	N	N	4	4	1
38	N	N	5	11	6	10	2	4	2	1	1	2	2	2	1	1	N	N	1	N	N	N	N	N	N	N	2	11	20	4
39	12	15	7	4	4	2	1	1	1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	22	4	N
40	9	1	1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	16	N	N
41	N	N	N	N	2	N	N	2	2	2	7	5	7	5	2	N	6	7	9	10	7	15	11	5	5	2	N	N	N	N

NOTES: ** = GREATER THAN 99.5 PERCENT; N = LESS THAN 0.5 PERCENT.
ROWS WITH ALL VALUES LESS THAN 0.5 PERCENT ARE NOT SHOWN.

TABLE E-7

TABLE 9. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) THAT AN OILSPILL STARTING AT A PARTICULAR LOCATION WILL CONTACT A CERTAIN LAND OR BOUNDARY SEGMENT WITHIN 3 DAYS.

SEGMENT	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
1																										12	N	N	N	N
3	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	N					
33																										N	1	N	N	N
39	15	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N					
44																										N	20	N	N	N
46																										N	N	5	N	N

NOTES: ** = GREATER THAN 99.5 PERCENT; N = LESS THAN 0.5 PERCENT.
ROWS WITH ALL VALUES LESS THAN 0.5 PERCENT ARE NOT SHOWN.

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TABLE E-8

TABLE 10. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) THAT AN OILSPILL STARTING
AT A PARTICULAR LOCATION WILL CONTACT A CERTAIN LAND OR BOUNDARY SEGMENT
WITHIN 10 DAYS.

SEGMENT	HYPOTHETICAL SPILL LOCATION																													
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
1																										22	N	N	N	N
2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	14	1	N	N	N	N
3	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2	N	16	7	4	N	N	N	N
4	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9	11	5	N					
5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	N	N	4	N	N					
33																										N	19	N	N	N
39	15	10	10	N	5	5	N	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	.	N	N	N	5
44																										.	25	N	N	N
46																										.	N	25	5	N
47	N	N	N	5	N	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	N
48	N	N	10	5	N	N	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N					
49	N	15	5	5	N	N	5	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N					
57																										20	N	N	N	N

NOTES: ** = GREATER THAN 99.5 PERCENT; N = LESS THAN 0.5 PERCENT.
ROWS WITH ALL VALUES LESS THAN 0.5 PERCENT ARE NOT SHOWN.

TABLE E-9

TABLE 11. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) THAT AN OILSPILL STARTING
AT A PARTICULAR LOCATION WILL CONTACT A CERTAIN LAND OR BOUNDARY SEGMENT
WITHIN 30 DAYS.

SEGMENT	HYPOTHETICAL SPILL LOCATION																													
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
1	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	10	5	22	N	N	N	N
2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	14	2	N	N	N	N
3	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2	N	16	9	5	N	N	N	N
4	N	N	N	N	N	N	N	N	N	N	2	N	N	2	2	N	N	N	5	N	2	14	11	6	1	7	N	N	N	N
5	N	N	N	N	N	N	N	N	N	2	N	2	2	N	N	N	2	5	2	4	6	2	12	5	6	N	N	N	N	2
6	N	N	N	N	1	N	N	N	2	N	2	5	7	7	10	2	7	2	5	10	7	5	4	5	2	1	N	N	N	N
7	N	N	N	N	N	N	N	2	4	2	N	1	5	5	2	7	5	10	9	7	10	4	4	4	N	1	N	N	N	2
8	2	N	N	N	N	N	N	N	4	2	2	2	N	4	5	10	6	2	5	1	4	4	4	1	1	4	N	N	N	2
9	N	N	N	N	N	N	N	N	N	N	N	N	N	N	1	2	7	4	2	2	N	N	N	N	N	N	N	N	N	2
10	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	1	N	N	N	N	N	N	N	N	N					
30																										N	1	N	N	N
31																										N	1	N	N	N
33																										N	30	17	N	N
39	50	10	10	N	5	5	5	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	20	5	10	5
44																										N	25	N	N	N
45																										N	N	25	5	N
47	N	N	N	5	N	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	N
48	N	N	10	5	N	N	5	N	N	N	N	N	N	N	N	5	5	N	N	N	N	N	N	N	N					
49	N	15	5	10	10	10	5	10	5	5	N	N	N	N	N	N	N	5	N	5	5	N	N	N	N	N	N	5	10	5
50	N	5	N	5	5	5	10	N	5	N	5	5	5	5	5	N	N	N	5	N	N	5	N	N	N	N	N	N	N	5
51	N	15	5	5	5	5	N	5	5	5	5	N	N	N	N	10	N	N	N	N	N	N	5	N	5	N	N	N	10	5
52	N	N	5	10	N	5	5	5	5	5	N	5	N	N	N	N	N	N	N	N	N	N	N	5	N	N	N	N	5	N
53	N	5	15	5	20	10	20	15	5	10	10	10	10	10	5	5	10	10	10	5	5	N	N	N	N					
54	N	N	N	N	N	N	N	5	5	5	15	10	5	10	10	N	N	5	N	5	N	10	5	5	N	N	N	N	N	5
55	N	N	N	N	N	N	N	N	N	5	5	5	10	15	20	5	5	10	20	N	10	10	10	10	15	10	N	N	N	N
56	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5	20	20	15	15	5	10	5	N	N	N	N
57	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	N	15	15	25	N	N	N	N

NOTES: ** = GREATER THAN 99.5 PERCENT; N = LESS THAN 0.5 PERCENT.
ROWS WITH ALL VALUES LESS THAN 0.5 PERCENT ARE NOT SHOWN.

TABLE E-10

TABLE 12. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF THE PROPOSED LEASE TRACTS USING TRANSPORTATION SCENARIO A.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0	58	0	0.9	26	0	0.3
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	17	0	0.2	6	0	0.1	27	0	0.3	10	0	0.1
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
BOTTOM FISHING 3	N	0	0.0	N	0	0.0	63	1	1.0	29	0	0.3	79	1	1.6	41	0	0.5
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	16	0	0.2	6	0	0.1	37	0	0.5	15	0	0.2
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	93	2	2.6	59	0	0.9	93	2	2.6	59	0	0.9	93	2	2.6	59	0	0.9
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-11

TABLE 13. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF THE PROPOSED LEASE TRACTS USING TRANSPORTATION SCENARIO B.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	11	0	0.1	5	0	0.0	25	0	0.3	11	0	0.1	73	1	1.3	45	0	0.6
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	13	0	0.1	6	0	0.1	28	0	0.3	15	0	0.2
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	3	0	0.0	2	0	0.0
BOTTOM FISHING 3	15	0	0.2	9	0	0.1	74	1	1.3	47	0	0.6	80	1	1.6	53	0	0.8
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	31	0	0.4	14	0	0.2	43	0	0.6	20	0	0.2
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	93	2	2.7	72	1	1.3	93	2	2.7	72	1	1.3	94	2	2.7	72	1	1.3
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-12

TABLE 14. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF THE PROPOSED LEASE TRACTS USING TRANSPORTATION SCENARIO C.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	16	0	0.2	9	0	0.1	55	0	0.8	33	0	0.4	85	1	1.9	57	0	0.9
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	11	0	0.1	5	0	0.0	33	0	0.4	15	0	0.2
BOTTOM FISHING 2	90	2	2.3	70	1	1.2	91	2	2.4	72	1	1.3	91	2	2.4	72	1	1.3
BOTTOM FISHING 3	32	0	0.4	11	0	0.1	75	1	1.4	40	0	0.5	82	1	1.7	48	0	0.7
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	14	0	0.2	6	0	0.1	28	0	0.3	12	0	0.1
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	88	2	2.2	54	0	0.8	92	2	2.5	61	0	0.9	92	2	2.5	62	0	1.0
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-13

TABLE 15. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF THE PROPOSED LEASE TRACTS USING TRANSPORTATION SCENARIO D.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	N	0	0.0	N	0	0.0	14	0	0.2	7	0	0.1	74	1	1.4	46	0	0.6
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	18	0	0.2	8	0	0.1	36	0	0.4	18	0	0.2
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	4	0	0.0	3	0	0.0
BOTTOM FISHING 3	19	0	0.2	12	0	0.1	86	1	2.0	60	0	0.9	91	2	2.4	66	1	1.1
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	19	0	0.2	8	0	0.1	40	0	0.5	18	0	0.2
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	98	4	4.1	84	1	1.8	98	4	4.1	84	1	1.8	98	4	4.1	84	1	1.8
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-14

TABLE 16. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS,
THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED
PRODUCTION LIFE OF TRACT DELETION ALTERNATIVE 1, USING TRANSPORTATION SCENARIO A.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0	57	0	0.9	26	0	0.3
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	18	0	0.2	7	0	0.1	27	0	0.3	10	0	0.1
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
BOTTOM FISHING 3	N	0	0.0	N	0	0.0	62	0	1.0	29	0	0.3	78	1	1.5	41	0	0.5
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	9	0	0.1	4	0	0.0	32	0	0.4	13	0	0.1
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	92	2	2.6	59	0	0.9	92	2	2.6	59	0	0.9	92	2	2.6	59	0	0.9
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-15

TABLE 17. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS,
THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED
PRODUCTION LIFE OF TRACT DELETION ALTERNATIVE 2, USING TRANSPORTATION SCENARIO B.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	7	0	0.1	3	0	0.0	17	0	0.2	7	0	0.1	42	0	0.5	22	0	0.3
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	8	0	0.1	5	0	0.0
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
BOTTOM FISHING 3	6	0	0.1	5	0	0.1	41	0	0.5	24	0	0.3	43	0	0.6	25	0	0.3
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	25	0	0.3	11	0	0.1	29	0	0.3	13	0	0.1
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	59	0	0.9	37	0	0.5	60	0	0.9	38	0	0.5	60	0	0.9	38	0	0.5
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-16

TABLE 18. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS,
THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED
PRODUCTION LIFE OF TRACT DELETION ALTERNATIVE 2, USING TRANSPORTATION SCENARIO C.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	9	0	0.1	5	0	0.0	34	0	0.4	19	0	0.2	55	0	0.8	31	0	0.4
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	11	0	0.1	5	0	0.0
BOTTOM FISHING 2	69	1	1.2	47	0	0.6	70	1	1.2	48	0	0.7	70	1	1.2	48	0	0.7
BOTTOM FISHING 3	16	0	0.2	5	0	0.1	48	0	0.7	21	0	0.2	51	0	0.7	23	0	0.3
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	16	0	0.2	7	0	0.1	21	0	0.2	9	0	0.1
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	56	0	0.8	23	0	0.3	62	0	1.0	29	0	0.3	64	1	1.0	31	0	0.4
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-17

TABLE 19. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS,
THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED
PRODUCTION LIFE OF TRACT DELETION ALTERNATIVE 3, USING TRANSPORTATION SCENARIO D.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0	33	0	0.4	18	0	0.2
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	8	0	0.1	5	0	0.0
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
BOTTOM FISHING 3	9	0	0.1	5	0	0.1	57	0	0.8	32	0	0.4	59	0	0.9	33	0	0.4
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	14	0	0.1	6	0	0.1	24	0	0.3	10	0	0.1
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	79	1	1.6	50	0	0.7	79	1	1.6	50	0	0.7	79	1	1.6	50	0	0.7
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-18

TABLE 20. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES OVER THE EXPECTED PRODUCTION LIFE OF THE PROPOSED LEASE TRACTS USING TRANSPORTATION SCENARIO A.

IMPACT ZONE	------- WITHIN 3 DAYS ---------						------- WITHIN 10 DAYS --------						------- WITHIN 30 DAYS --------					
	≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0
3	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0
4	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0
5	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0	7	0	0.1	3	0	0.0
6	11	0	0.1	4	0	0.0	25	0	0.3	10	0	0.1	25	0	0.3	10	0	0.1
7	37	0	0.5	16	0	0.2	41	0	0.5	18	0	0.2	45	0	0.6	20	0	0.2
8	14	0	0.2	5	0	0.1	31	0	0.4	12	0	0.1	35	0	0.4	14	0	0.2
10	2	0	0.0	1	0	0.0	16	0	0.2	6	0	0.1	21	0	0.2	8	0	0.1
11	N	0	0.0	N	0	0.0	41	0	0.5	16	0	0.2	60	0	0.9	27	0	0.3
12	N	0	0.0	N	0	0.0	19	0	0.2	7	0	0.1	42	0	0.6	17	0	0.2
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	30	0	0.4	11	0	0.1
14	56	0	0.8	25	0	0.3	60	0	0.9	27	0	0.3	63	1	1.0	29	0	0.3
15	8	0	0.1	2	0	0.0	30	0	0.4	11	0	0.1	31	0	0.4	11	0	0.1
16	13	0	0.1	5	0	0.1	29	0	0.3	11	0	0.1	30	0	0.4	12	0	0.1
17	28	0	0.3	13	0	0.1	42	0	0.5	19	0	0.2	42	0	0.5	19	0	0.2
18	1	0	0.0	N	0	0.0	3	0	0.0	2	0	0.0	4	0	0.0	2	0	0.0
19	N	0	0.0	N	0	0.0	23	0	0.3	9	0	0.1	54	0	0.8	23	0	0.3
20	N	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0	50	0	0.7	20	0	0.2
21	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.1	27	0	0.3	12	0	0.1
22	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.0	28	0	0.3	12	0	0.1
23	17	0	0.2	6	0	0.1	29	0	0.3	13	0	0.1	31	0	0.4	14	0	0.2
24	7	0	0.1	3	0	0.0	9	0	0.1	4	0	0.0	9	0	0.1	4	0	0.0
25	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
26	4	0	0.0	2	0	0.0	8	0	0.1	4	0	0.0	16	0	0.2	6	0	0.1
27	4	0	0.0	2	0	0.0	6	0	0.1	2	0	0.0	6	0	0.1	2	0	0.0
31	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	4	0	0.0	2	0	0.0
32	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	18	0	0.2	8	0	0.1
33	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	21	0	0.2	8	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	21	0	0.2	8	0	0.1
35	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	4	0	0.0
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0
41	N	0	0.0	N	0	0.0	13	0	0.1	5	0	0.0	18	0	0.2	6	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-19

TABLE 21. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES OVER THE EXPECTED PRODUCTION LIFE OF THE PROPOSED LEASE TRACTS USING TRANSPORTATION SCENARIO B.

IMPACT ZONE	------- WITHIN 3 DAYS ---------						------- WITHIN 10 DAYS --------						------- WITHIN 30 DAYS --------					
	≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	4	0	0.0
3	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	7	0	0.1
4	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	13	0	0.1	7	0	0.1
5	N	0	0.0	N	0	0.0	15	0	0.2	9	0	0.1	15	0	0.2	9	0	0.1
6	29	0	0.3	17	0	0.2	40	0	0.5	24	0	0.3	42	0	0.5	25	0	0.3
7	50	0	0.7	30	0	0.4	56	0	0.8	34	0	0.4	60	0	0.9	37	0	0.5
8	8	0	0.1	3	0	0.0	29	0	0.3	15	0	0.2	40	0	0.5	22	0	0.2
9	24	0	0.3	15	0	0.2	24	0	0.3	15	0	0.2	26	0	0.3	16	0	0.2
10	2	0	0.0	1	0	0.0	23	0	0.3	13	0	0.1	32	0	0.4	17	0	0.2
11	N	0	0.0	N	0	0.0	26	0	0.3	12	0	0.1	58	0	0.9	32	0	0.4
12	N	0	0.0	N	0	0.0	11	0	0.1	5	0	0.0	45	0	0.6	23	0	0.3
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	24	0	0.3	12	0	0.1
14	38	0	0.5	18	0	0.2	47	0	0.6	24	0	0.3	57	0	0.9	31	0	0.4
15	18	0	0.2	9	0	0.1	33	0	0.4	17	0	0.2	35	0	0.4	18	0	0.2
16	11	0	0.1	5	0	0.0	29	0	0.3	13	0	0.1	39	0	0.5	19	0	0.2
17	36	0	0.5	17	0	0.2	50	0	0.7	25	0	0.3	53	0	0.7	26	0	0.3
18	2	0	0.0	1	0	0.0	13	0	0.1	5	0	0.1	20	0	0.2	8	0	0.1
19	N	0	0.0	N	0	0.0	37	0	0.5	19	0	0.2	53	0	0.8	28	0	0.3
20	N	0	0.0	N	0	0.0	20	0	0.2	11	0	0.1	51	0	0.7	29	0	0.3
21	N	0	0.0	N	0	0.0	33	0	0.4	15	0	0.2	46	0	0.6	21	0	0.2
22	N	0	0.0	N	0	0.0	23	0	0.3	11	0	0.1	35	0	0.4	17	0	0.2
23	45	0	0.6	21	0	0.2	56	0	0.8	27	0	0.3	58	0	0.9	29	0	0.3
24	28	0	0.3	12	0	0.1	36	0	0.4	16	0	0.2	37	0	0.5	16	0	0.2
25	N	0	0.0	N	0	0.0	15	0	0.2	6	0	0.1	15	0	0.2	6	0	0.1
26	24	0	0.3	11	0	0.1	34	0	0.4	15	0	0.2	37	0	0.5	17	0	0.2
27	12	0	0.1	5	0	0.0	32	0	0.4	14	0	0.2	32	0	0.4	14	0	0.2
28	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
30	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0	13	0	0.1	6	0	0.1
31	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0	28	0	0.3	12	0	0.1
32	N	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0	41	0	0.5	19	0	0.2
33	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	33	0	0.4	15	0	0.2
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	18	0	0.2	8	0	0.1
35	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	15	0	0.2	6	0	0.1
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	20	0	0.2	8	0	0.1
40	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
41	N	0	0.0	N	0	0.0	10	0	0.1	5	0	0.0	21	0	0.2	11	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-20

TABLE 22. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS,
THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES
OVER THE EXPECTED PRODUCTION LIFE OF
THE PROPOSED LEASE TRACTS USING TRANSPORTATION SCENARIO C.

IMPACT ZONE	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
2	N	0	0.0	N	0	0.0	18	0	0.2	10	0	0.1	34	0	0.4	18	0	0.2
3	N	0	0.0	N	0	0.0	50	0	0.7	31	0	0.4	57	0	0.8	34	0	0.4
4	42	0	0.5	25	0	0.3	65	1	1.1	41	0	0.5	69	1	1.2	43	0	0.6
5	55	0	0.8	31	0	0.4	69	1	1.2	43	0	0.6	70	1	1.2	44	0	0.6
6	24	0	0.3	10	0	0.1	43	0	0.6	18	0	0.2	45	0	0.6	20	0	0.2
7	45	0	0.6	19	0	0.2	51	0	0.7	22	0	0.3	56	0	0.8	26	0	0.3
8	7	0	0.1	3	0	0.0	26	0	0.3	10	0	0.1	54	0	0.8	28	0	0.3
9	15	0	0.2	5	0	0.0	44	0	0.6	23	0	0.3	51	0	0.7	28	0	0.3
10	2	0	0.0	1	0	0.0	22	0	0.3	8	0	0.1	51	0	0.7	26	0	0.3
11	N	0	0.0	N	0	0.0	24	0	0.3	11	0	0.1	55	0	0.8	27	0	0.3
12	N	0	0.0	N	0	0.0	11	0	0.1	5	0	0.0	37	0	0.5	17	0	0.2
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	24	0	0.3	10	0	0.1
14	39	0	0.5	18	0	0.2	45	0	0.6	21	0	0.2	50	0	0.7	24	0	0.3
15	5	0	0.0	1	0	0.0	21	0	0.2	8	0	0.1	21	0	0.2	8	0	0.1
16	10	0	0.1	4	0	0.0	21	0	0.2	9	0	0.1	23	0	0.3	10	0	0.1
17	26	0	0.3	12	0	0.1	36	0	0.4	17	0	0.2	36	0	0.4	17	0	0.2
18	1	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	4	0	0.0	2	0	0.0
19	N	0	0.0	N	0	0.0	22	0	0.3	8	0	0.1	41	0	0.5	18	0	0.2
20	N	0	0.0	N	0	0.0	30	0	0.4	14	0	0.1	55	0	0.8	27	0	0.3
21	N	0	0.0	N	0	0.0	11	0	0.1	5	0	0.1	24	0	0.3	11	0	0.1
22	N	0	0.0	N	0	0.0	11	0	0.1	5	0	0.0	23	0	0.3	10	0	0.1
23	16	0	0.2	7	0	0.1	27	0	0.3	12	0	0.1	28	0	0.3	13	0	0.1
24	6	0	0.1	3	0	0.0	9	0	0.1	4	0	0.0	9	0	0.1	4	0	0.0
25	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
26	3	0	0.0	2	0	0.0	8	0	0.1	4	0	0.0	12	0	0.1	5	0	0.1
27	3	0	0.0	2	0	0.0	5	0	0.1	2	0	0.0	5	0	0.1	2	0	0.0
31	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	4	0	0.0	2	0	0.0
32	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	17	0	0.2	8	0	0.1
33	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	20	0	0.2	8	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	14	0	0.1	6	0	0.1
35	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.0	2	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0
41	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0	26	0	0.3	12	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-21

TABLE 23. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS,
THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES
OVER THE EXPECTED PRODUCTION LIFE OF
THE PROPOSED LEASE TRACTS USING TRANSPORTATION SCENARIO D.

IMPACT ZONE	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	6	0	0.1
3	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	18	0	0.2	10	0	0.1
4	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	18	0	0.2	10	0	0.1
5	N	0	0.0	N	0	0.0	21	0	0.2	12	0	0.1	21	0	0.2	12	0	0.1
6	40	0	0.5	25	0	0.3	51	0	0.7	31	0	0.4	51	0	0.7	31	0	0.4
7	62	0	1.0	39	0	0.5	70	1	1.2	46	0	0.6	72	1	1.3	47	0	0.6
8	11	0	0.1	4	0	0.0	40	0	0.5	21	0	0.2	52	0	0.7	29	0	0.3
9	35	0	0.4	23	0	0.3	36	0	0.4	23	0	0.3	37	0	0.5	24	0	0.3
10	2	0	0.0	1	0	0.0	33	0	0.4	18	0	0.2	45	0	0.6	26	0	0.3
11	N	0	0.0	N	0	0.0	36	0	0.4	15	0	0.2	71	1	1.2	41	0	0.5
12	N	0	0.0	N	0	0.0	17	0	0.2	7	0	0.1	56	0	0.8	29	0	0.3
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	35	0	0.4	16	0	0.2
14	51	0	0.7	23	0	0.3	65	1	1.0	34	0	0.4	69	1	1.2	38	0	0.5
15	28	0	0.3	15	0	0.2	49	0	0.7	26	0	0.3	50	0	0.7	26	0	0.3
16	17	0	0.2	7	0	0.1	35	0	0.4	15	0	0.2	37	0	0.5	16	0	0.2
17	31	0	0.4	14	0	0.1	49	0	0.7	23	0	0.3	49	0	0.7	23	0	0.3
18	1	0	0.0	N	0	0.0	5	0	0.0	2	0	0.0	5	0	0.1	2	0	0.0
19	N	0	0.0	N	0	0.0	42	0	0.6	23	0	0.3	65	1	1.0	34	0	0.4
20	N	0	0.0	N	0	0.0	25	0	0.3	15	0	0.2	66	1	1.1	40	0	0.5
21	N	0	0.0	N	0	0.0	15	0	0.2	6	0	0.1	31	0	0.4	13	0	0.1
22	N	0	0.0	N	0	0.0	16	0	0.2	7	0	0.1	33	0	0.4	14	0	0.1
23	20	0	0.2	9	0	0.1	34	0	0.4	15	0	0.2	36	0	0.4	16	0	0.2
24	8	0	0.1	3	0	0.0	12	0	0.1	5	0	0.0	12	0	0.1	5	0	0.0
25	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0
26	4	0	0.0	2	0	0.0	10	0	0.1	4	0	0.0	16	0	0.2	6	0	0.1
27	4	0	0.0	2	0	0.0	7	0	0.1	3	0	0.0	7	0	0.1	3	0	0.0
31	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	5	0	0.1	2	0	0.0
32	N	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0	22	0	0.2	9	0	0.1
33	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	30	0	0.4	14	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	24	0	0.3	11	0	0.1
35	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	6	0	0.1
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
41	N	0	0.0	N	0	0.0	15	0	0.2	6	0	0.1	30	0	0.4	15	0	0.2

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-22

TABLE 24. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES OVER THE EXPECTED PRODUCTION LIFE OF TRACT DELETION ALTERNATIVE 1, USING TRANSPORTATION SCENARIO A.

IMPACT ZONE	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
3	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
4	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
5	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0	8	0	0.1	3	0	0.0
6	11	0	0.1	5	0	0.0	26	0	0.3	11	0	0.1	26	0	0.3	11	0	0.1
7	39	0	0.5	17	0	0.2	42	0	0.5	18	0	0.2	45	0	0.6	20	0	0.2
8	15	0	0.2	5	0	0.1	31	0	0.4	12	0	0.1	35	0	0.4	14	0	0.2
10	2	0	0.0	1	0	0.0	16	0	0.2	6	0	0.1	21	0	0.2	8	0	0.1
11	N	0	0.0	N	0	0.0	42	0	0.5	17	0	0.2	59	0	0.9	27	0	0.3
12	N	0	0.0	N	0	0.0	19	0	0.2	7	0	0.1	40	0	0.5	16	0	0.2
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	30	0	0.4	12	0	0.1
14	57	0	0.9	26	0	0.3	61	0	0.9	28	0	0.3	64	1	1.0	30	0	0.3
15	6	0	0.1	1	0	0.0	29	0	0.3	10	0	0.1	29	0	0.3	10	0	0.1
16	14	0	0.1	5	0	0.1	27	0	0.3	11	0	0.1	27	0	0.3	11	0	0.1
17	17	0	0.2	7	0	0.1	32	0	0.4	13	0	0.1	32	0	0.4	13	0	0.1
18	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
19	N	0	0.0	N	0	0.0	20	0	0.2	8	0	0.1	53	0	0.7	23	0	0.3
20	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	50	0	0.7	21	0	0.2
21	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0	20	0	0.2	9	0	0.1
22	N	0	0.0	N	0	0.0	9	0	0.1	3	0	0.0	25	0	0.3	10	0	0.1
23	4	0	0.0	2	0	0.0	17	0	0.2	7	0	0.1	19	0	0.2	8	0	0.1
24	1	0	0.0	1	0	0.0	4	0	0.0	2	0	0.0	4	0	0.0	2	0	0.0
26	1	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	11	0	0.1	4	0	0.0
27	1	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
31	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
32	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	10	0	0.1	4	0	0.0
33	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	17	0	0.2	7	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	21	0	0.2	8	0	0.1
35	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
41	N	0	0.0	N	0	0.0	13	0	0.1	5	0	0.1	17	0	0.2	6	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-23

TABLE 25. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES OVER THE EXPECTED PRODUCTION LIFE OF TRACT DELETION ALTERNATIVE 2, USING TRANSPORTATION SCENARIO B.

IMPACT ZONE	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	2	0	0.0
3	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	3	0	0.0
4	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	4	0	0.0	3	0	0.0
5	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0	6	0	0.1	3	0	0.0
6	12	0	0.1	8	0	0.1	15	0	0.2	9	0	0.1	17	0	0.2	10	0	0.1
7	17	0	0.2	11	0	0.1	21	0	0.2	13	0	0.1	27	0	0.3	16	0	0.2
8	N	0	0.0	N	0	0.0	6	0	0.1	4	0	0.0	14	0	0.2	8	0	0.1
9	13	0	0.1	8	0	0.1	14	0	0.1	8	0	0.1	15	0	0.2	9	0	0.1
10	N	0	0.0	N	0	0.0	7	0	0.1	4	0	0.0	12	0	0.1	7	0	0.1
11	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	25	0	0.3	13	0	0.1
12	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	26	0	0.3	13	0	0.1
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	3	0	0.0
14	N	0	0.0	N	0	0.0	7	0	0.1	4	0	0.0	19	0	0.2	10	0	0.1
15	7	0	0.1	4	0	0.0	9	0	0.1	6	0	0.1	11	0	0.1	7	0	0.1
16	7	0	0.1	3	0	0.0	17	0	0.2	8	0	0.1	26	0	0.3	12	0	0.1
17	34	0	0.4	16	0	0.2	42	0	0.6	20	0	0.2	44	0	0.6	21	0	0.2
18	2	0	0.0	1	0	0.0	10	0	0.1	4	0	0.0	16	0	0.2	6	0	0.1
19	N	0	0.0	N	0	0.0	26	0	0.3	13	0	0.1	29	0	0.3	15	0	0.2
20	N	0	0.0	N	0	0.0	10	0	0.1	6	0	0.1	15	0	0.2	9	0	0.1
21	N	0	0.0	N	0	0.0	27	0	0.3	12	0	0.1	37	0	0.5	16	0	0.2
22	N	0	0.0	N	0	0.0	18	0	0.2	8	0	0.1	25	0	0.3	12	0	0.1
23	38	0	0.5	17	0	0.2	47	0	0.6	22	0	0.2	48	0	0.7	23	0	0.3
24	22	0	0.2	9	0	0.1	28	0	0.3	12	0	0.1	29	0	0.3	12	0	0.1
25	N	0	0.0	N	0	0.0	11	0	0.1	4	0	0.0	11	0	0.1	4	0	0.0
26	16	0	0.2	7	0	0.1	27	0	0.3	11	0	0.1	27	0	0.3	11	0	0.1
27	10	0	0.1	4	0	0.0	24	0	0.3	10	0	0.1	24	0	0.3	10	0	0.1
28	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0
30	N	0	0.0	N	0	0.0	5	0	0.0	2	0	0.0	9	0	0.1	3	0	0.0
31	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0	21	0	0.2	8	0	0.1
32	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	35	0	0.4	15	0	0.2
33	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	24	0	0.3	11	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.1
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	15	0	0.2	6	0	0.1
40	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
41	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	8	0	0.1	4	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-24

TABLE 26. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES OVER THE EXPECTED PRODUCTION LIFE OF TRACT DELETION ALTERNATIVE 2, USING TRANSPORTATION SCENARIO C.

IMPACT ZONE	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
2	N	0	0.0	N	0	0.0	10	0	0.1	5	0	0.1	17	0	0.2	9	0	0.1
3	N	0	0.0	N	0	0.0	30	0	0.4	17	0	0.2	32	0	0.4	18	0	0.2
4	24	0	0.3	14	0	0.2	41	0	0.5	24	0	0.3	42	0	0.5	24	0	0.3
5	32	0	0.4	17	0	0.2	42	0	0.5	24	0	0.3	43	0	0.6	24	0	0.3
6	11	0	0.1	3	0	0.0	16	0	0.2	5	0	0.1	18	0	0.2	6	0	0.1
7	13	0	0.1	3	0	0.0	19	0	0.2	6	0	0.1	25	0	0.3	9	0	0.1
8	N	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0	27	0	0.3	13	0	0.1
9	7	0	0.1	2	0	0.0	24	0	0.3	12	0	0.1	29	0	0.3	15	0	0.2
10	N	0	0.0	N	0	0.0	6	0	0.1	1	0	0.0	26	0	0.3	12	0	0.1
11	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	27	0	0.3	11	0	0.1
12	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	25	0	0.3	10	0	0.1
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
14	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0	16	0	0.2	6	0	0.1
15	6	0	0.1	1	0	0.0	7	0	0.1	2	0	0.0	7	0	0.1	2	0	0.0
16	7	0	0.1	3	0	0.0	15	0	0.2	6	0	0.1	18	0	0.2	7	0	0.1
17	30	0	0.4	14	0	0.1	35	0	0.4	17	0	0.2	35	0	0.4	17	0	0.2
18	1	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	4	0	0.0	2	0	0.0
19	N	0	0.0	N	0	0.0	23	0	0.3	9	0	0.1	26	0	0.3	11	0	0.1
20	N	0	0.0	N	0	0.0	17	0	0.2	7	0	0.1	21	0	0.2	9	0	0.1
21	N	0	0.0	N	0	0.0	13	0	0.1	6	0	0.1	22	0	0.2	10	0	0.1
22	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.1	19	0	0.2	8	0	0.1
23	19	0	0.2	9	0	0.1	28	0	0.3	13	0	0.1	28	0	0.3	13	0	0.1
24	7	0	0.1	3	0	0.0	10	0	0.1	4	0	0.0	10	0	0.1	4	0	0.0
25	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
26	4	0	0.0	2	0	0.0	9	0	0.1	4	0	0.0	9	0	0.1	4	0	0.0
27	4	0	0.0	2	0	0.0	6	0	0.1	3	0	0.0	6	0	0.1	3	0	0.0
31	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	4	0	0.0	2	0	0.0
32	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	19	0	0.2	9	0	0.1
33	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	18	0	0.2	7	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.0	2	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	4	0	0.0
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
41	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-25

TABLE 27. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES OVER THE EXPECTED PRODUCTION LIFE OF TRACT DELETION ALTERNATIVE 3, USING TRANSPORTATION SCENARIO D.

IMPACT ZONE	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
3	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	3	0	0.0
4	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	5	0	0.1	3	0	0.0
5	N	0	0.0	N	0	0.0	7	0	0.1	4	0	0.0	7	0	0.1	4	0	0.0
6	15	0	0.2	10	0	0.1	18	0	0.2	11	0	0.1	18	0	0.2	11	0	0.1
7	21	0	0.2	13	0	0.1	30	0	0.4	18	0	0.2	35	0	0.4	20	0	0.2
8	N	0	0.0	N	0	0.0	8	0	0.1	5	0	0.1	20	0	0.2	11	0	0.1
9	17	0	0.2	10	0	0.1	17	0	0.2	11	0	0.1	17	0	0.2	11	0	0.1
10	N	0	0.0	N	0	0.0	9	0	0.1	6	0	0.1	18	0	0.2	10	0	0.1
11	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	34	0	0.4	17	0	0.2
12	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	36	0	0.4	16	0	0.2
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	4	0	0.0
14	N	0	0.0	N	0	0.0	17	0	0.2	8	0	0.1	25	0	0.3	12	0	0.1
15	19	0	0.2	8	0	0.1	21	0	0.2	10	0	0.1	21	0	0.2	10	0	0.1
16	14	0	0.1	5	0	0.1	24	0	0.3	10	0	0.1	25	0	0.3	10	0	0.1
17	25	0	0.3	10	0	0.1	35	0	0.4	15	0	0.2	35	0	0.4	15	0	0.2
18	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
19	N	0	0.0	N	0	0.0	36	0	0.4	17	0	0.2	41	0	0.5	19	0	0.2
20	N	0	0.0	N	0	0.0	13	0	0.1	7	0	0.1	22	0	0.2	13	0	0.1
21	N	0	0.0	N	0	0.0	11	0	0.1	4	0	0.0	21	0	0.2	9	0	0.1
22	N	0	0.0	N	0	0.0	14	0	0.1	6	0	0.1	23	0	0.3	9	0	0.1
23	6	0	0.1	2	0	0.0	20	0	0.2	9	0	0.1	20	0	0.2	9	0	0.1
24	2	0	0.0	1	0	0.0	7	0	0.1	3	0	0.0	7	0	0.1	3	0	0.0
26	1	0	0.0	1	0	0.0	5	0	0.0	2	0	0.0	5	0	0.0	2	0	0.0
27	1	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0
31	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
32	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	15	0	0.2	6	0	0.1
33	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	21	0	0.2	9	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	4	0	0.0
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
41	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	11	0	0.1	6	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-26

TABLE 28. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND OR BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE PROPOSED LEASE TRACTS USING TRANSPORTATION SCENARIO A.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
5	N	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0	11	0	0.1	4	0	0.0
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	7	0	0.1
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	7	0	0.1
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	15	0	0.2	6	0	0.1
9	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	4	0	0.0
10	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
39	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	4	0	0.0	2	0	0.0
47	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
48	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	10	0	0.1	4	0	0.0
49	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	14	0	0.2	6	0	0.1
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	5	0	0.1
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	31	0	0.4	12	0	0.1
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	4	0	0.0
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	12	0	0.1	4	0	0.0
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	14	0	0.2	6	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-27

TABLE 29. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND OR BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE PROPOSED LEASE TRACTS USING TRANSPORTATION SCENARIO B.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	2	0	0.0
4	N	0	0.0	N	0	0.0	3	0	0.0	2	0	0.0	6	0	0.1	4	0	0.0
5	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	12	0	0.1	6	0	0.1
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	18	0	0.2	9	0	0.1
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	9	0	0.1
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	15	0	0.2	7	0	0.1
9	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0
10	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
39	11	0	0.1	5	0	0.0	19	0	0.2	8	0	0.1	35	0	0.4	16	0	0.2
47	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0
48	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0	11	0	0.1	4	0	0.0
49	N	0	0.0	N	0	0.0	15	0	0.2	6	0	0.1	26	0	0.3	11	0	0.1
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	15	0	0.2	7	0	0.1
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	22	0	0.3	10	0	0.1
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	5	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	40	0	0.5	20	0	0.2
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	16	0	0.2	8	0	0.1
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	21	0	0.2	12	0	0.1
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	20	0	0.2	11	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-28

TABLE 30. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND OR BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE PROPOSED LEASE TRACTS USING TRANSPORTATION SCENARIO C.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	15	0	0.2	9	0	0.1	26	0	0.3	15	0	0.2	32	0	0.4	18	0	0.2
2	N	0	0.0	N	0	0.0	18	0	0.2	10	0	0.1	19	0	0.2	11	0	0.1
3	1	0	0.0	N	0	0.0	18	0	0.2	9	0	0.1	21	0	0.2	10	0	0.1
4	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	17	0	0.2	8	0	0.1
5	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	18	0	0.2	8	0	0.1
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	20	0	0.2	9	0	0.1
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	7	0	0.1
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	5	0	0.1
9	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
10	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
39	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	4	0	0.0	2	0	0.0
47	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
48	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	6	0	0.1	2	0	0.0
49	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	14	0	0.1	6	0	0.1
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	2	0	0.0
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	16	0	0.2	8	0	0.1
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	24	0	0.3	10	0	0.1
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	4	0	0.0
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	40	0	0.5	20	0	0.2
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	35	0	0.4	17	0	0.2
57	N	0	0.0	N	0	0.0	23	0	0.3	13	0	0.1	45	0	0.6	28	0	0.3

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-29

TABLE 31. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND OR BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE PROPOSED LEASE TRACTS USING TRANSPORTATION SCENARIO B.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	3	0	0.0
4	N	0	0.0	N	0	0.0	5	0	0.0	3	0	0.0	8	0	0.1	5	0	0.0
5	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0	20	0	0.2	10	0	0.1
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	26	0	0.3	13	0	0.1
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	28	0	0.3	14	0	0.1
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	9	0	0.1
9	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	4	0	0.0
10	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
39	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0	5	0	0.1	2	0	0.0
47	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
48	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	9	0	0.1	3	0	0.0
49	N	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0	18	0	0.2	8	0	0.1
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	6	0	0.1
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	15	0	0.2	6	0	0.1
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	41	0	0.5	20	0	0.2
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	20	0	0.2	9	0	0.1
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	30	0	0.4	16	0	0.2
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	27	0	0.3	15	0	0.2

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-30

TABLE 32. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND OR BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF TRACT DELETION ALTERNATIVE 1, USING TRANSPORTATION SCENARIO A.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
5	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	11	0	0.1	4	0	0.0
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	7	0	0.1
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	7	0	0.1
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	16	0	0.2	6	0	0.1
9	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	12	0	0.1	4	0	0.0
10	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
39	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
47	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
48	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	3	0	0.0
49	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	11	0	0.1	4	0	0.0
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	4	0	0.0
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	26	0	0.3	10	0	0.1
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	4	0	0.0
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	4	0	0.0
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	15	0	0.2	6	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-31

TABLE 33. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND OR BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF TRACT DELETION ALTERNATIVE 2, USING TRANSPORTATION SCENARIO B.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS			≥ 1.000 BBLS			≥ 10.000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
4	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	3	0	0.0	2	0	0.0
5	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	3	0	0.0	2	0	0.0
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.0	3	0	0.0
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	3	0	0.0
39	7	0	0.1	3	0	0.0	15	0	0.2	6	0	0.1	25	0	0.3	11	0	0.1
47	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0
48	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0	6	0	0.1	2	0	0.0
49	N	0	0.0	N	0	0.0	11	0	0.1	4	0	0.0	19	0	0.2	8	0	0.1
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	5	0	0.1
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	15	0	0.2	6	0	0.1
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	4	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	25	0	0.3	12	0	0.1
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	4	0	0.0
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	5	0	0.1
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E.32

TABLE 34. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS,
THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND OR
BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF
TRACT DELETION ALTERNATIVE 2, USING TRANSPORTATION SCENARIO C.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	4	0	0.1	5	0	0.0	14	0	0.2	8	0	0.1	18	0	0.2	10	0	0.1
2	N	0	0.0	N	0	0.0	10	0	0.1	5	0	0.1	10	0	0.1	6	0	0.1
3	1	0	0.0	N	0	0.0	4	0	0.1	5	0	0.0	11	0	0.1	5	0	0.1
4	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	8	0	0.1	4	0	0.0
5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
39	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	4	0	0.0	2	0	0.0
47	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
48	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
49	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	11	0	0.1	5	0	0.0
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	5	0	0.0
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	17	0	0.2	7	0	0.1
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	2	0	0.0
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	21	0	0.2	10	0	0.1
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	14	0	0.1	6	0	0.1
57	N	0	0.0	N	0	0.0	13	0	0.1	7	0	0.1	26	0	0.3	14	0	0.2

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E.33

TABLE 35. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS,
THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND OR
BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF
TRACT DELETION ALTERNATIVE 3, USING TRANSPORTATION SCENARIO D.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS			≥ 1,000 BBLS			≥ 10,000 BBLS		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
4	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	3	0	0.0	2	0	0.0
5	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	5	0	0.1	3	0	0.0
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	4	0	0.0
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	5	0	0.0
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0
39	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0
47	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0
49	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	11	0	0.1	5	0	0.0
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	4	0	0.0
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	4	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	20	0	0.2	9	0	0.1
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.1
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	6	0	0.1
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	4	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E.34

TABLE B-1. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS,
THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED
PRODUCTION LIFE OF THE LEASE AREA, FOR SPILLS 1,000 BARRELS AND GREATER.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	PROPOSED			TANKERING AND PROPOSED			PROPOSED			TANKERING AND PROPOSED			PROPOSED			TANKERING AND PROPOSED		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	N	0	0.0	N	0	0.0	8	0	0.1	12	0	0.1	58	0	0.9	68	1	1.1
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	17	0	0.2	18	0	0.2	27	0	0.3	30	0	0.4
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0
BOTTOM FISHING 3	N	0	0.0	6	0	0.1	63	1	1.0	69	1	1.2	79	1	1.6	83	1	1.8
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	16	0	0.2	16	0	0.2	37	0	0.5	39	0	0.5
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	93	2	2.6	95	2	3.0	93	2	2.6	95	3	3.0	93	2	2.6	95	3	3.0
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	2	0	0.0	6	0	0.1
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-35

TABLE B-2. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, FOR SPILLS 10,000 BARRELS AND GREATER.

TARGET	WITHIN 3 DAYS PROPOSED			WITHIN 3 DAYS TANKERING AND PROPOSED			WITHIN 10 DAYS PROPOSED			WITHIN 10 DAYS TANKERING AND PROPOSED			WITHIN 30 DAYS PROPOSED			WITHIN 30 DAYS TANKERING AND PROPOSED		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	N	0	0.0	N	0	0.0	3	0	0.0	6	0	0.1	26	0	0.3	37	0	0.5
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	6	0	0.1	7	0	0.1	10	0	0.1	12	0	0.1
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0
BOTTOM FISHING 3	N	0	0.0	4	0	0.0	29	0	0.3	36	0	0.5	41	0	0.5	48	0	0.7
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	6	0	0.1	6	0	0.1	15	0	0.2	17	0	0.2
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	59	0	0.9	67	1	1.1	59	0	0.9	67	1	1.1	59	0	0.9	68	1	1.1
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	3	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-36

TABLE B-3. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, FOR SPILLS 1,000 BARRELS AND GREATER.

IMPACT ZONE	WITHIN 3 DAYS PROPOSED			WITHIN 3 DAYS TANKERING AND PROPOSED			WITHIN 10 DAYS PROPOSED			WITHIN 10 DAYS TANKERING AND PROPOSED			WITHIN 30 DAYS PROPOSED			WITHIN 30 DAYS TANKERING AND PROPOSED		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0
2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	6	0	0.1
3	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	10	0	0.1
4	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	7	0	0.1	11	0	0.1
5	N	0	0.0	N	0	0.0	7	0	0.1	12	0	0.1	7	0	0.1	12	0	0.1
6	11	0	0.1	17	0	0.2	25	0	0.3	31	0	0.4	25	0	0.3	31	0	0.4
7	37	0	0.5	40	0	0.5	41	0	0.5	45	0	0.6	45	0	0.6	49	0	0.7
8	14	0	0.2	14	0	0.2	31	0	0.4	35	0	0.4	35	0	0.4	41	0	0.5
9	N	0	0.0	12	0	0.1	N	0	0.0	13	0	0.1	N	0	0.0	13	0	0.1
10	2	0	0.0	2	0	0.0	16	0	0.2	22	0	0.2	21	0	0.2	28	0	0.3
11	N	0	0.0	N	0	0.0	41	0	0.5	42	0	0.5	60	0	0.9	64	1	1.0
12	N	0	0.0	N	0	0.0	19	0	0.2	20	0	0.2	42	0	0.6	46	0	0.6
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	30	0	0.4	33	0	0.4
14	56	0	0.8	57	0	0.8	60	0	0.9	63	0	1.0	63	1	1.0	65	1	1.1
15	8	0	0.1	8	0	0.1	30	0	0.4	34	0	0.4	31	0	0.4	34	0	0.4
16	13	0	0.1	24	0	0.3	29	0	0.3	38	0	0.5	30	0	0.4	39	0	0.5
17	28	0	0.3	28	0	0.3	42	0	0.5	43	0	0.6	42	0	0.5	43	0	0.6
18	1	0	0.0	4	0	0.0	3	0	0.0	7	0	0.1	4	0	0.0	7	0	0.1
19	N	0	0.0	N	0	0.0	23	0	0.3	24	0	0.3	54	0	0.8	57	0	0.8
20	N	0	0.0	N	0	0.0	4	0	0.0	7	0	0.1	50	0	0.7	54	0	0.8
21	N	0	0.0	N	0	0.0	12	0	0.1	13	0	0.1	27	0	0.3	31	0	0.4
22	N	0	0.0	N	0	0.0	12	0	0.1	12	0	0.1	28	0	0.3	31	0	0.4
23	17	0	0.2	17	0	0.2	29	0	0.3	30	0	0.4	31	0	0.4	33	0	0.4
24	7	0	0.1	7	0	0.1	9	0	0.1	13	0	0.1	9	0	0.1	13	0	0.1
25	N	0	0.0	N	0	0.0	2	0	0.0	2	0	0.0	2	0	0.0	3	0	0.0
26	4	0	0.0	4	0	0.0	8	0	0.1	11	0	0.1	16	0	0.2	19	0	0.2
27	4	0	0.0	4	0	0.0	6	0	0.1	9	0	0.1	6	0	0.1	9	0	0.1
28	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0
30	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	N	0	0.0	2	0	0.0
31	N	0	0.0	2	0	0.0	3	0	0.0	5	0	0.1	4	0	0.0	6	0	0.1
32	N	0	0.0	4	0	0.0	3	0	0.0	8	0	0.1	18	0	0.2	23	0	0.3
33	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	21	0	0.2	24	0	0.3
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	21	0	0.2	24	0	0.3
35	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	8	0	0.1
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	4	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	14	0	0.1
39	N	0	0.0	1	0	0.0	N	0	0.0	3	0	0.0	3	0	0.0	7	0	0.1
40	N	0	0.0	2	0	0.0	N	0	0.0	2	0	0.0	N	0	0.0	2	0	0.0
41	N	0	0.0	N	0	0.0	13	0	0.1	15	0	0.2	18	0	0.2	21	0	0.2

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-37

TABLE B-4. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS,
THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES
OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA,
FOR SPILLS 10,000 BARRELS AND GREATER.

IMPACT ZONE	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	PROPOSED			TANKERING AND PROPOSED			PROPOSED			TANKERING AND PROPOSED			PROPOSED			TANKERING AND PROPOSED		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0
3	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.0
4	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1
5	N	0	0.0	N	0	0.0	1	0	0.0	6	0	0.1	4	0	0.0	6	0	0.1
6	N	0	0.0	8	0	0.1	N	0	0.0	15	0	0.2	7	0	0.1	15	0	0.2
7	N	0	0.0	18	0	0.2	N	0	0.0	21	0	0.2	7	0	0.1	23	0	0.3
8	N	0	0.0	5	0	0.1	N	0	0.0	15	0	0.2	6	0	0.1	18	0	0.2
9	N	0	0.0	8	0	0.1	N	0	0.0	8	0	0.1	4	0	0.0	8	0	0.1
10	N	0	0.0	1	0	0.0	N	0	0.0	10	0	0.1	N	0	0.0	13	0	0.1
11	N	0	0.0	N	0	0.0	N	0	0.0	17	0	0.2	N	0	0.0	31	0	0.4
12	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	N	0	0.0	21	0	0.2
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	14	0	0.1
14	N	0	0.0	26	0	0.3	N	0	0.0	29	0	0.3	N	0	0.0	32	0	0.4
15	N	0	0.0	2	0	0.0	N	0	0.0	13	0	0.1	N	0	0.0	13	0	0.1
16	N	0	0.0	12	0	0.1	N	0	0.0	18	0	0.2	N	0	0.0	19	0	0.2
17	N	0	0.0	13	0	0.1	N	0	0.0	20	0	0.2	N	0	0.0	20	0	0.2
18	N	0	0.0	2	0	0.0	N	0	0.0	3	0	0.0	N	0	0.0	4	0	0.0
19	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	N	0	0.0	26	0	0.3
20	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	N	0	0.0	25	0	0.3
21	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	N	0	0.0	15	0	0.2
22	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.0	N	0	0.0	14	0	0.1
23	N	0	0.0	8	0	0.1	N	0	0.0	14	0	0.1	N	0	0.0	15	0	0.2
24	N	0	0.0	3	0	0.0	N	0	0.0	6	0	0.1	N	0	0.0	6	0	0.1
25	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0
26	N	0	0.0	2	0	0.0	N	0	0.0	5	0	0.1	N	0	0.0	8	0	0.1
27	N	0	0.0	2	0	0.0	N	0	0.0	5	0	0.0	N	0	0.0	5	0	0.0
30	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0
31	N	0	0.0	1	0	0.0	N	0	0.0	3	0	0.0	N	0	0.0	3	0	0.0
32	N	0	0.0	3	0	0.0	N	0	0.0	5	0	0.0	N	0	0.0	11	0	0.1
33	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	10	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1
35	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1
39	N	0	0.0	1	0	0.0	2	0	0.0	2	0	0.0	2	0	0.0	3	0	0.0
40	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0
41	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	N	0	0.0	8	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-38

TABLE B-5. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS,
THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND OR BOUNDARY SEGMENTS
OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA,
FOR SPILLS 1,000 BARRELS AND GREATER.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	PROPOSED			TANKERING AND PROPOSED			PROPOSED			TANKERING AND PROPOSED			PROPOSED			TANKERING AND PROPOSED		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0
4	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	2	0	0.0
5	N	0	0.0	N	0	0.0	4	0	0.0	4	0	0.0	11	0	0.1	14	0	0.1
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	20	0	0.2
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	22	0	0.2
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	15	0	0.2	17	0	0.2
9	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	12	0	0.1
10	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
33	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	N	0	0.0	6	0	0.1
39	N	0	0.0	N	0	0.0	4	0	0.0	5	0	0.0	4	0	0.0	9	0	0.1
44	N	0	0.0	3	0	0.0	N	0	0.0	3	0	0.0	N	0	0.0	3	0	0.0
46	N	0	0.0	1	0	0.0	N	0	0.0	4	0	0.0	N	0	0.0	4	0	0.0
47	N	0	0.0	N	0	0.0	2	0	0.0	2	0	0.0	2	0	0.0	2	0	0.0
48	N	0	0.0	N	0	0.0	2	0	0.0	2	0	0.0	10	0	0.1	10	0	0.1
49	N	0	0.0	N	0	0.0	3	0	0.0	3	0	0.0	14	0	0.2	18	0	0.2
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	6	0	0.1
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	15	0	0.2
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	8	0	0.1
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	31	0	0.4	32	0	0.4
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	12	0	0.1
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	12	0	0.1	16	0	0.2
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	14	0	0.2	18	0	0.2

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-39

TABLE B-6. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND OR BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA. FOR SPILLS 10,000 BARRELS AND GREATER.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	PROPOSED			TANKERING AND PROPOSED			PROPOSED			TANKERING AND PROPOSED			PROPOSED			TANKERING AND PROPOSED		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0
4	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0
5	N	0	0.0	N	0	0.0	1	0	0.0	2	0	0.0	4	0	0.0	6	0	0.1
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	8	0	0.1
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	9	0	0.1
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	6	0	0.1
9	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	4	0	0.0
33	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	4	0	0.0
39	N	0	0.0	N	0	0.0	2	0	0.0	2	0	0.0	2	0	0.0	5	0	0.0
44	N	0	0.0	2	0	0.0	N	0	0.0	2	0	0.0	N	0	0.0	2	0	0.0
46	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	N	0	0.0	2	0	0.0
47	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0
48	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	4	0	0.0	4	0	0.0
49	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	6	0	0.1	8	0	0.1
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	3	0	0.0
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	7	0	0.1
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	3	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	12	0	0.1	13	0	0.1
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	5	0	0.0
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	6	0	0.1
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	8	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-40

TABLE N1. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA. TRACT DELETION ALTERNATIVE 1. USING TRANSPORTATION SCENARIO B.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	9	0	0.1	4	0	0.0	21	0	0.2	10	0	0.1	70	1	1.2	42	0	0.6
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	13	0	0.1	6	0	0.1	28	0	0.3	14	0	0.2
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
BOTTOM FISHING 3	14	0	0.1	8	0	0.1	73	1	1.3	46	0	0.6	80	1	1.6	52	0	0.7
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	24	0	0.3	11	0	0.1	38	0	0.5	18	0	0.2
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	93	2	2.7	71	1	1.2	93	2	2.7	71	1	1.2	93	2	2.7	71	1	1.2
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-41

TABLE N2. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA. TRACT DELETION ALTERNATIVE 1. USING TRANSPORTATION SCENARIO C.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	15	0	0.2	8	0	0.1	51	0	0.7	38	0	0.4	83	1	1.8	55	0	0.8
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.1	32	0	0.4	15	0	0.2
BOTTOM FISHING 2	87	2	2.1	67	1	1.1	89	2	2.2	68	1	1.1	89	2	2.2	68	1	1.1
BOTTOM FISHING 3	31	0	0.4	10	0	0.1	73	1	1.3	39	0	0.5	81	1	1.7	47	0	0.6
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0	23	0	0.3	10	0	0.1
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	88	2	2.1	55	0	0.8	91	2	2.4	61	0	0.9	92	2	2.5	62	0	1.0
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-42

TABLE N3. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, TRACT DELETION ALTERNATIVE 1, USING TRANSPORTATION SCENARIO D.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS.			≥ 10.000 BBLS.			≥ 1.000 BBLS.			≥ 10.000 BBLS.			≥ 1.000 BBLS.			≥ 10.000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	N	0	0.0	N	0	0.0	11	0	0.1	6	0	0.1	73	1	1.3	44	0	0.6
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	14	0	0.2	8	0	0.1	35	0	0.4	18	0	0.2
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	4	0	0.0	2	0	0.0
BOTTOM FISHING 3	18	0	0.2	11	0	0.1	84	1	1.9	57	0	0.9	90	2	2.3	64	1	1.0
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.1	35	0	0.4	15	0	0.2
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	98	3	4.0	83	1	1.7	98	3	4.0	83	1	1.8	98	3	4.0	83	1	1.8
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-43

TABLE N4. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, TRACT DELETION ALTERNATIVE 2, USING TRANSPORTATION SCENARIO A.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS.			≥ 10.000 BBLS.			≥ 1.000 BBLS.			≥ 10.000 BBLS.			≥ 1.000 BBLS.			≥ 10.000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	N	0	0.0	N	0	0.0	5	0	0.0	2	0	0.0	22	0	0.2	8	0	0.1
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	2	0	0.0	N	0	0.0	5	0	0.0	1	0	0.0
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
BOTTOM FISHING 3	N	0	0.0	N	0	0.0	40	0	0.5	15	0	0.2	45	0	0.6	17	0	0.2
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	18	0	0.2	7	0	0.1	26	0	0.3	11	0	0.1
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	62	0	1.0	26	0	0.3	62	0	1.0	26	0	0.3	62	0	1.0	26	0	0.3
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-44

TABLE N5. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, TRACT DELETION ALTERNATIVE 2, USING TRANSPORTATION SCENARIO D.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS.			≥ 10.000 BBLS.			≥ 1.000 BBLS.			≥ 10.000 BBLS.			≥ 1.000 BBLS.			≥ 10.000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	N	0	0.0	N	0	0.0	9	0	0.1	4	0	0.0	38	0	0.5	21	0	0.2
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	10	0	0.1	6	0	0.1
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
BOTTOM FISHING 3	11	0	0.1	7	0	0.1	61	0	0.9	36	0	0.4	62	0	1.0	36	0	0.5
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	21	0	0.2	9	0	0.1	30	0	0.4	12	0	0.1
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	81	1	1.7	54	0	0.8	82	1	1.7	54	0	0.8	82	1	1.7	54	0	0.8
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-48

TABLE N6. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, TRACT DELETION ALTERNATIVE 3, USING TRANSPORTATION SCENARIO A.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS.			≥ 10.000 BBLS.			≥ 1.000 BBLS.			≥ 10.000 BBLS.			≥ 1.000 BBLS.			≥ 10.000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	19	0	0.2	7	0	0.1
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	2	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
BOTTOM FISHING 3	N	0	0.0	N	0	0.0	38	0	0.5	14	0	0.2	43	0	0.6	17	0	0.2
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.0	21	0	0.2	8	0	0.1
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	60	0	0.9	26	0	0.3	61	0	0.9	26	0	0.3	61	0	0.9	26	0	0.3
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-46

TABLE N7. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA. TRACT DELETION ALTERNATIVE 3, USING TRANSPORTATION SCENARIO B.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	5	0	0.1	2	0	0.0	12	0	0.1	5	0	0.1	35	0	0.4	18	0	0.2
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	6	0	0.1	4	0	0.0
BOTTOM FISHING 2	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
BOTTOM FISHING 3	7	0	0.1	4	0	0.0	39	0	0.5	22	0	0.2	41	0	0.5	23	0	0.3
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	18	0	0.2	8	0	0.1	24	0	0.3	11	0	0.1
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	57	0	0.9	35	0	0.4	58	0	0.9	35	0	0.4	58	0	0.9	35	0	0.4
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-47

TABLE N8. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA. TRACT DELETION ALTERNATIVE 3, USING TRANSPORTATION SCENARIO C.

TARGET	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
LAND	7	0	0.1	4	0	0.0	27	0	0.3	15	0	0.2	48	0	0.7	26	0	0.3
BOTTOM FISHING 1	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	9	0	0.1	4	0	0.0
BOTTOM FISHING 2	60	0	0.9	40	0	0.5	62	0	1.0	41	0	0.5	62	0	1.0	41	0	0.5
BOTTOM FISHING 3	13	0	0.1	4	0	0.0	44	0	0.6	19	0	0.2	47	0	0.6	21	0	0.2
BOTTOM FISHING 4	N	0	0.0	N	0	0.0	10	0	0.1	4	0	0.0	17	0	0.2	7	0	0.1
BOTTOM FISHING 5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
POLLECK EGGS AREA	54	0	0.8	24	0	0.3	60	0	0.9	29	0	0.3	61	0	0.9	30	0	0.4
KING CRAB AREA 1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
KING CRAB AREA 2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0
YELLOWFIN SOLE AREA	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
YELLOWFIN SOLE (HIGH	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT.

TABLE E-48

TABLE N9. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND AND BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA. TRACT DELETION ALTERNATIVE 1, USING TRANSPORTATION SCENARIO B.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
4	N	0	0.0	N	0	0.0	3	0	0.0	2	0	0.0	6	0	0.1	3	0	0.0
5	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	12	0	0.1	6	0	0.1
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	18	0	0.2	9	0	0.1
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	9	0	0.1
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	15	0	0.2	7	0	0.1
9	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0
10	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
39	9	0	0.1	4	0	0.0	15	0	0.2	6	0	0.1	29	0	0.3	13	0	0.1
47	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
48	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	9	0	0.1	3	0	0.0
49	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.0	22	0	0.2	10	0	0.1
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	6	0	0.1
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	9	0	0.1
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	4	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	36	0	0.4	18	0	0.2
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	16	0	0.2	8	0	0.1
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	20	0	0.2	11	0	0.1
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	20	0	0.2	10	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-49

TABLE N10. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND AND BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA. TRACT DELETION ALTERNATIVE 1, USING TRANSPORTATION SCENARIO C.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	14	0	0.1	8	0	0.1	24	0	0.3	13	0	0.1	30	0	0.4	17	0	0.2
2	N	0	0.0	N	0	0.0	16	0	0.2	9	0	0.1	18	0	0.2	10	0	0.1
3	1	0	0.0	N	0	0.0	16	0	0.2	8	0	0.1	19	0	0.2	9	0	0.1
4	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	15	0	0.2	7	0	0.1
5	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	17	0	0.2	8	0	0.1
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	20	0	0.2	8	0	0.1
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	18	0	0.2	7	0	0.1
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	5	0	0.1
9	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0
10	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
39	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
47	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
48	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
49	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	11	0	0.1	4	0	0.0
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	14	0	0.1	7	0	0.1
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	20	0	0.2	8	0	0.1
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	4	0	0.0
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	37	0	0.5	19	0	0.2
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	34	0	0.4	16	0	0.2
57	N	0	0.0	N	0	0.0	21	0	0.2	12	0	0.1	42	0	0.5	24	0	0.3

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-50

TABLE N11. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND AND BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA. TRACT DELETION ALTERNATIVE 1, USING TRANSPORTATION SCENARIO D.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
4	N	0	0.0	N	0	0.0	4	0	0.0	3	0	0.0	7	0	0.1	4	0	0.0
5	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0	19	0	0.2	9	0	0.1
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	26	0	0.3	12	0	0.1
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	28	0	0.3	13	0	0.1
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	9	0	0.1
9	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	4	0	0.0
10	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
39	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
47	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
48	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	2	0	0.0
49	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	14	0	0.2	6	0	0.1
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	5	0	0.1
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	5	0	0.1
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	4	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	36	0	0.4	17	0	0.2
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	9	0	0.1
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	28	0	0.3	15	0	0.2
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	26	0	0.3	14	0	0.2

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-51

TABLE N12. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND AND BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA. TRACT DELETION ALTERNATIVE 2, USING TRANSPORTATION SCENARIO A.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	1	0	0.0
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0
9	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	N	0	0.0
39	N	0	0.0	N	0	0.0	5	0	0.0	2	0	0.0	5	0	0.0	2	0	0.0
47	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
48	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0
49	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	12	0	0.1	5	0	0.1
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	3	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	21	0	0.2	8	0	0.1
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	1	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-52

TABLE N13. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND AND BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, TRACT DELETION ALTERNATIVE 2, USING TRANSPORTATION SCENARIO D.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
4	N	0	0.0	N	0	0.0	3	0	0.0	2	0	0.0	4	0	0.0	3	0	0.0
5	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	7	0	0.1	4	0	0.0
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	5	0	0.1
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	5	0	0.1
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0
9	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
39	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0	6	0	0.1	2	0	0.0
47	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
48	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0
49	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	14	0	0.2	6	0	0.1
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	5	0	0.0
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	4	0	0.0
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	26	0	0.3	12	0	0.1
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	5	0	0.1
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	8	0	0.1
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	5	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-53

TABLE N14. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND AND BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, TRACT DELETION ALTERNATIVE 3, USING TRANSPORTATION SCENARIO A.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0
9	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	N	0	0.0
39	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0
47	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0
48	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
49	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	9	0	0.1	4	0	0.0
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	16	0	0.2	6	0	0.1
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.0	1	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-54

TABLE N15. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND AND BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, TRACT DELETION ALTERNATIVE 3, USING TRANSPORTATION SCENARIO B.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
4	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	3	0	0.0	2	0	0.0
5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.0	2	0	0.0
39	5	0	0.1	2	0	0.0	11	0	0.1	4	0	0.0	19	0	0.2	8	0	0.1
47	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
48	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0
49	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0	15	0	0.2	6	0	0.1
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	4	0	0.0
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.1
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	3	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	20	0	0.2	9	0	0.1
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	4	0	0.0
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	4	0	0.0
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	3	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-55

TABLE N16. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND AND BOUNDARY SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA. TRACT DELETION ALTERNATIVE 3, USING TRANSPORTATION SCENARIO C.

SEGMENT	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS.			≥ 10.000 BBLS.			≥ 1.000 BBLS.			≥ 10.000 BBLS.			≥ 1.000 BBLS.			≥ 10.000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	7	0	0.1	4	0	0.0	11	0	0.1	6	0	0.1	15	0	0.2	8	0	0.1
2	N	0	0.0	N	0	0.0	8	0	0.1	4	0	0.0	8	0	0.1	5	0	0.0
3	N	0	0.0	N	0	0.0	7	0	0.1	4	0	0.0	9	0	0.1	4	0	0.0
4	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0
5	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0
6	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
7	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
8	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
39	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0
47	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0
49	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	9	0	0.1	4		0.0
50	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0
51	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	4	0	0.0
52	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0
53	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	5	0	0.1
54	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	2	0	0.0
55	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	18	0	0.2	8	0	0.1
56	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	5	0	0.1
57	N	0	0.0	N	0	0.0	10	0	0.1	6	0	0.1	21	0	0.2	12	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. SEGMENTS WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-56

TABLE N17. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, TRACT DELETION ALTERNATIVE 1, USING TRANSPORTATION SCENARIO B.

IMPACT ZONE	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1.000 BBLS.			≥ 10.000 BBLS.			≥ 1.000 BBLS.			≥ 10.000 BBLS.			≥ 1.000 BBLS.			≥ 10.000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	4	0	0.0
3	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	12	0	0.1	7	0	0.1
4	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	12	0	0.1	7	0	0.1
5	N	0	0.0	N	0	0.0	15	0	0.2	8	0	0.1	15	0	0.2	8	0	0.1
6	27	0	0.3	16	0	0.2	38	0	0.5	22	0	0.3	40	0	0.5	24	0	0.3
7	49	0	0.7	29	0	0.3	55	0	0.8	33	0	0.4	59	0	0.9	35	0	0.4
8	8	0	0.1	4	0	0.0	29	0	0.3	15	0	0.2	39	0	0.5	21	0	0.2
9	21	0	0.2	13	0	0.1	22	0	0.2	14	0	0.1	23	0	0.3	15	0	0.2
10	2	0	0.0	1	0	0.0	23	0	0.3	12	0	0.1	31	0	0.4	17	0	0.2
11	N	0	0.0	N	0	0.0	27	0	0.3	12	0	0.1	57	0	0.9	31	0	0.4
12	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.1	44	0	0.6	22	0	0.2
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	25	0	0.3	12	0	0.1
14	40	0	0.5	19	0	0.2	49	0	0.7	24	0	0.3	57	0	0.9	31	0	0.4
15	17	0	0.2	9	0	0.1	32	0	0.4	16	0	0.2	34	0	0.4	17	0	0.2
16	12	0	0.1	5	0	0.0	29	0	0.3	13	0	0.1	36	0	0.4	17	0	0.2
17	28	0	0.3	12	0	0.1	42	0	0.6	20	0	0.2	44	0	0.6	21	0	0.2
18	1	0	0.0	N	0	0.0	9	0	0.1	3	0	0.0	15	0	0.2	6	0	0.1
19	N	0	0.0	N	0	0.0	36	0	0.4	18	0	0.2	53	0	0.8	28	0	0.3
20	N	0	0.0	N	0	0.0	18	0	0.2	10	0	0.1	51	0	0.7	28	0	0.3
21	N	0	0.0	N	0	0.0	26	0	0.3	12	0	0.1	39	0	0.5	18	0	0.2
22	N	0	0.0	N	0	0.0	19	0	0.2	9	0	0.1	32	0	0.4	15	0	0.2
23	32	0	0.4	14	0	0.1	45	0	0.6	21	0	0.2	47	0	0.6	22	0	0.2
24	21	0	0.2	8	0	0.1	28	0	0.3	12	0	0.1	29	0	0.3	13	0	0.1
25	N	0	0.0	N	0	0.0	11	0	0.1	4	0	0.0	11	0	0.1	4	0	0.0
26	19	0	0.2	8	0	0.1	27	0	0.3	12	0	0.1	30	0	0.4	13	0	0.1
27	8	0	0.1	3	0	0.0	25	0	0.3	11	0	0.1	25	0	0.3	11	0	0.1
28	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
30	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0	11	0	0.1	5	0	0.0
31	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0	22	0	0.2	10	0	0.1
32	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	32	0	0.4	14	0	0.2
33	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	30	0	0.3	13	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	17	0	0.2	8	0	0.1
35	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	4	0	0.0
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	16	0	0.2	7	0	0.1
40	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.0	2	0	0.0
41	N	0	0.0	N	0	0.0	10	0	0.1	5	0	0.0	21	0	0.2	10	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. ZONES WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

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TABLE E-57

TABLE N18. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA. TRACT DELETION ALTERNATIVE 1, USING TRANSPORTATION SCENARIO C.

IMPACT ZONE	WITHIN 3 DAYS ≥ 1,000 BBLS.			WITHIN 3 DAYS ≥ 10,000 BBLS.			WITHIN 10 DAYS ≥ 1,000 BBLS.			WITHIN 10 DAYS ≥ 10,000 BBLS.			WITHIN 30 DAYS ≥ 1,000 BBLS.			WITHIN 30 DAYS ≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
2	N	0	0.0	N	0	0.0	16	0	0.2	9	0	0.1	32	0	0.4	17	0	0.2
3	N	0	0.0	N	0	0.0	47	0	0.6	28	0	0.3	54	0	0.8	31	0	0.4
4	39	0	0.5	23	0	0.3	62	0	1.0	38	0	0.5	65	1	1.1	40	0	0.5
5	51	0	0.7	29	0	0.3	66	1	1.1	40	0	0.5	66	1	1.1	41	0	0.5
6	28	0	0.3	10	0	0.1	42	0	0.5	18	0	0.2	44	0	0.6	19	0	0.2
7	44	0	0.6	19	0	0.2	50	0	0.7	22	0	0.3	54	0	0.8	25	0	0.3
8	8	0	0.1	3	0	0.0	26	0	0.3	11	0	0.1	53	0	0.7	27	0	0.3
9	14	0	0.2	4	0	0.0	41	0	0.5	21	0	0.2	48	0	0.7	26	0	0.3
10	2	0	0.0	1	0	0.0	22	0	0.3	8	0	0.1	48	0	0.7	24	0	0.3
11	N	0	0.0	N	0	0.0	25	0	0.3	11	0	0.1	54	0	0.8	26	0	0.3
12	N	0	0.0	N	0	0.0	11	0	0.1	5	0	0.0	34	0	0.4	16	0	0.2
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	24	0	0.3	10	0	0.1
14	41	0	0.5	19	0	0.2	46	0	0.6	22	0	0.2	50	0	0.7	24	0	0.3
15	4	0	0.0	1	0	0.0	20	0	0.2	8	0	0.1	20	0	0.2	8	0	0.1
16	11	0	0.1	4	0	0.0	20	0	0.2	9	0	0.1	20	0	0.2	9	0	0.1
17	16	0	0.2	7	0	0.1	26	0	0.3	11	0	0.1	26	0	0.3	11	0	0.1
18	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
19	N	0	0.0	N	0	0.0	20	0	0.2	8	0	0.1	40	0	0.5	18	0	0.2
20	N	0	0.0	N	0	0.0	27	0	0.3	12	0	0.1	54	0	0.8	26	0	0.3
21	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0	18	0	0.2	8	0	0.1
22	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0	20	0	0.2	9	0	0.1
23	4	0	0.0	2	0	0.0	14	0	0.2	6	0	0.1	16	0	0.2	7	0	0.1
24	1	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	4	0	0.0	2	0	0.0
26	1	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	7	0	0.1	3	0	0.0
27	1	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
31	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
32	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	9	0	0.1	4	0	0.0
33	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	16	0	0.2	7	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	13	0	0.1	6	0	0.1
35	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
41	N	0	0.0	N	0	0.0	9	0	0.1	4	0	0.0	25	0	0.3	11	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. ZONES WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-58

TABLE N19. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA. TRACT DELETION ALTERNATIVE 1, USING TRANSPORTATION SCENARIO D.

IMPACT ZONE	WITHIN 3 DAYS ≥ 1,000 BBLS.			WITHIN 3 DAYS ≥ 10,000 BBLS.			WITHIN 10 DAYS ≥ 1,000 BBLS.			WITHIN 10 DAYS ≥ 10,000 BBLS.			WITHIN 30 DAYS ≥ 1,000 BBLS.			WITHIN 30 DAYS ≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	11	0	0.1	6	0	0.1
3	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	17	0	0.2	9	0	0.1
4	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	17	0	0.2	9	0	0.1
5	N	0	0.0	N	0	0.0	20	0	0.2	11	0	0.1	20	0	0.2	11	0	0.1
6	37	0	0.5	23	0	0.3	49	0	0.7	30	0	0.4	49	0	0.7	30	0	0.4
7	61	0	0.9	38	0	0.5	68	1	1.2	44	0	0.6	70	1	1.2	45	0	0.6
8	12	0	0.1	4	0	0.0	40	0	0.5	21	0	0.2	51	0	0.7	28	0	0.3
9	32	0	0.4	21	0	0.2	33	0	0.4	21	0	0.2	33	0	0.4	22	0	0.2
10	2	0	0.0	1	0	0.0	32	0	0.4	17	0	0.2	44	0	0.6	24	0	0.3
11	N	0	0.0	N	0	0.0	37	0	0.5	16	0	0.2	70	1	1.2	40	0	0.5
12	N	0	0.0	N	0	0.0	18	0	0.2	7	0	0.1	53	0	0.8	27	0	0.3
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	35	0	0.4	16	0	0.2
14	53	0	0.8	24	0	0.3	65	1	1.1	34	0	0.4	69	1	1.2	38	0	0.5
15	25	0	0.3	14	0	0.1	48	0	0.7	25	0	0.3	48	0	0.7	25	0	0.3
16	17	0	0.2	7	0	0.1	33	0	0.4	15	0	0.2	34	0	0.4	15	0	0.2
17	19	0	0.2	8	0	0.1	38	0	0.5	17	0	0.2	38	0	0.5	17	0	0.2
18	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
19	N	0	0.0	N	0	0.0	39	0	0.5	20	0	0.2	63	1	1.0	33	0	0.4
20	N	0	0.0	N	0	0.0	23	0	0.3	14	0	0.1	65	1	1.1	38	0	0.5
21	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0	23	0	0.3	9	0	0.1
22	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.1	28	0	0.3	12	0	0.1
23	4	0	0.0	2	0	0.0	19	0	0.2	8	0	0.1	22	0	0.2	9	0	0.1
24	2	0	0.0	1	0	0.0	5	0	0.1	2	0	0.0	5	0	0.1	2	0	0.0
26	1	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	10	0	0.1	4	0	0.0
27	1	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
31	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
32	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	12	0	0.1	5	0	0.1
33	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	25	0	0.3	12	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	24	0	0.3	10	0	0.1
35	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	4	0	0.0
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
41	N	0	0.0	N	0	0.0	15	0	0.2	7	0	0.1	29	0	0.3	15	0	0.2

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. ZONES WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-59

TABLE N20. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, TRACT DELETION ALTERNATIVE 2, USING TRANSPORTATION SCENARIO A.

IMPACT ZONE	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
6	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
7	1	0	0.0	N	0	0.0	8	0	0.1	2	0	0.0	14	0	0.1	5	0	0.0
8	2	0	0.0	N	0	0.0	5	0	0.0	1	0	0.0	12	0	0.1	4	0	0.0
10	N	0	0.0	N	0	0.0	2	0	0.0	N	0	0.0	7	0	0.1	2	0	0.0
11	N	0	0.0	N	0	0.0	6	0	0.1	1	0	0.0	28	0	C.3	10	0	0.1
12	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	28	0	0.3	11	0	0.1
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	2	0	0.0
14	5	0	0.0	1	0	0.0	14	0	0.2	4	0	0.0	21	0	0.2	7	0	0.1
15	9	0	0.1	2	0	0.0	14	0	0.2	4	0	0.0	15	0	0.2	4	0	0.0
16	8	0	0.1	3	0	0.0	20	0	0.2	7	0	0.1	22	0	0.2	9	0	0.1
17	31	0	0.4	14	0	0.2	39	0	0.5	18	0	0.2	39	0	0.5	18	0	0.2
18	1	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	5	0	0.0	2	0	0.0
19	N	0	0.0	N	0	0.0	26	0	0.3	10	0	0.1	35	0	0.4	13	0	0.1
20	N	0	0.0	N	0	0.0	5	0	0.1	1	0	0.0	14	0	0.2	4	0	0.0
21	N	0	0.0	N	0	0.0	14	0	0.1	6	0	0.1	24	0	0.3	11	0	0.1
22	N	0	0.0	N	0	0.0	14	0	0.1	6	0	0.1	22	0	0.2	9	0	0.1
23	19	0	0.2	9	0	0.1	30	0	0.4	13	0	0.1	30	0	0.4	13	0	0.1
24	8	0	0.1	3	0	0.0	11	0	0.1	5	0	0.0	11	0	0.1	5	0	0.0
25	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
26	4	0	0.0	2	0	0.0	10	0	0.1	4	0	0.0	10	0	0.1	4	0	0.0
27	4	0	0.0	2	0	0.0	6	0	0.1	3	0	0.0	6	0	0.1	3	0	0.0
31	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	5	0	0.0	2	0	0.0
32	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	21	0	0.2	9	0	0.1
33	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	19	0	0.2	8	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0
35	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	4	0	0.0
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
41	N	0	0.0	N	0	0.0	2	0	0.0	N	0	0.0	7	0	0.1	2	0	0.0

NUTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. ZONES WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-60

TABLE N21. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, TRACT DELETION ALTERNATIVE 2, USING TRANSPORTATION SCENARIO D.

IMPACT ZONE	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	3	0	0.0
3	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	4	0	0.0
4	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	7	0	0.1	4	0	0.0
5	N	0	0.0	N	0	0.0	9	0	0.1	5	0	0.1	9	0	0.1	5	0	0.1
6	19	0	0.2	12	0	0.1	22	0	0.2	14	0	0.1	22	0	0.3	14	0	0.1
7	25	0	0.3	16	0	0.2	35	0	0.4	21	0	0.2	40	0	0.5	24	0	0.3
8	N	0	0.0	N	0	0.0	10	0	0.1	6	0	0.1	22	0	0.3	12	0	0.1
9	20	0	0.2	13	0	0.1	21	0	0.2	13	0	0.1	21	0	0.2	13	0	0.1
10	N	0	0.0	N	0	0.0	12	0	0.1	7	0	0.1	21	0	0.2	12	0	0.1
11	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	37	0	0.5	19	0	0.2
12	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	38	0	0.5	18	0	0.2
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	5	0	0.1
14	N	0	0.0	N	0	0.0	18	0	0.2	9	0	0.1	28	0	0.3	14	0	0.1
15	21	0	0.2	10	0	0.1	24	0	0.3	12	0	0.1	24	0	0.3	12	0	0.1
16	13	0	0.1	5	0	0.0	25	0	0.3	10	0	0.1	27	0	0.3	11	0	0.1
17	34	0	0.4	15	0	0.2	45	0	0.6	21	0	0.2	45	0	0.6	21	0	0.2
18	1	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0	6	0	0.1	2	0	0.0
19	N	0	0.0	N	0	0.0	38	0	0.5	18	0	0.2	42	0	0.5	20	0	0.2
20	N	0	0.0	N	0	0.0	16	0	0.2	9	0	0.1	26	0	0.3	15	0	0.2
21	N	0	0.0	N	0	0.0	17	0	0.2	7	0	0.1	28	0	0.3	12	0	0.1
22	N	0	0.0	N	0	0.0	17	0	0.2	7	0	0.1	26	0	0.3	11	0	0.1
23	23	0	0.3	10	0	0.1	35	0	0.4	16	0	0.2	35	0	0.4	16	0	0.2
24	9	0	0.1	4	0	0.0	14	0	0.1	5	0	0.1	14	0	0.1	5	0	0.1
25	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0
26	5	0	0.0	2	0	0.0	11	0	0.1	5	0	0.0	11	0	0.1	5	0	0.0
27	5	0	0.0	2	0	0.0	8	0	0.1	3	0	0.0	8	0	0.1	3	0	0.0
31	N	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0	6	0	0.1	2	0	0.0
32	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	24	0	0.3	10	0	0.1
33	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	25	0	0.3	11	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	4	0	0.0
35	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	12	0	0.1	5	0	0.1
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.0	2	0	0.0
41	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0	13	0	0.1	7	0	0.1

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. ZONES WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-81

TABLE N22. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES
OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA,
TRACT DELETION ALTERNATIVE 3, USING TRANSPORTATION
SCENARIO A.

IMPACT ZONE	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
6	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
7	1	0	0.0	N	0	0.0	7	0	0.1	2	0	0.0	12	0	0.1	4	0	0.0
8	1	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0	11	0	0.1	4	0	0.0
10	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	7	0	0.1	2	0	0.0
11	N	0	0.0	N	0	0.0	5	0	0.0	1	0	0.0	26	0	0.3	10	0	0.1
12	N	0	0.0	N	0	0.0	2	0	0.0	N	0	0.0	26	0	0.3	10	0	0.1
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	8	0	0.1	2	0	0.0
14	4	0	0.0	1	0	0.0	13	0	0.1	4	0	0.0	20	0	0.2	7	0	0.1
15	8	0	0.1	2	0	0.0	12	0	0.1	3	0	0.0	12	0	0.1	3	0	0.0
16	9	0	0.1	4	0	0.0	19	0	0.2	7	0	0.1	20	0	0.2	8	0	0.1
17	22	0	0.2	9	0	0.1	29	0	0.3	13	0	0.1	29	0	0.3	13	0	0.1
18	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
19	N	0	0.0	N	0	0.0	26	0	0.3	10	0	0.1	34	0	0.4	14	0	0.1
20	N	0	0.0	N	0	0.0	4	0	0.0	1	0	0.0	12	0	0.1	3	0	0.0
21	N	0	0.0	N	0	0.0	8	0	0.1	4	0	0.0	18	0	0.2	8	0	0.1
22	N	0	0.0	N	0	0.0	11	0	0.1	5	0	0.0	19	0	0.2	8	0	0.1
23	5	0	0.1	2	0	0.0	17	0	0.2	7	0	0.1	17	0	0.2	7	0	0.1
24	2	0	0.0	1	0	0.0	5	0	0.1	2	0	0.0	5	0	0.1	2	0	0.0
26	1	0	0.0	1	0	0.0	4	0	0.0	2	0	0.0	5	0	0.0	2	0	0.0
27	1	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0
31	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
32	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	13	0	0.1	6	0	0.1
33	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	16	0	0.2	6	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	2	0	0.0
35	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
41	N	0	0.0	N	0	0.0	2	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0

NUTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. ZONES WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE E-82

TABLE N23. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES
OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA,
TRACT DELETION ALTERNATIVE 3, USING TRANSPORTATION
SCENARIO B.

IMPACT ZONE	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
1	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
2	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
3	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	2	0	0.0
4	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	3	0	0.0	2	0	0.0
5	N	0	0.0	N	0	0.0	4	0	0.0	3	0	0.0	4	0	0.0	3	0	0.0
6	10	0	0.1	6	0	0.1	12	0	0.1	8	0	0.1	14	0	0.1	8	0	0.1
7	14	0	0.1	9	0	0.1	18	0	0.2	11	0	0.1	23	0	0.3	13	0	0.1
8	N	0	0.0	N	0	0.0	5	0	0.1	3	0	0.0	13	0	0.1	7	0	0.1
9	11	0	0.1	7	0	0.1	11	0	0.1	7	0	0.1	12	0	0.1	7	0	0.1
10	N	0	0.0	N	0	0.0	6	0	0.1	4	0	0.0	10	0	0.1	6	0	0.1
11	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	24	0	0.3	12	0	0.1
12	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	25	0	0.3	12	0	0.1
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	3	0	0.0
14	N	0	0.0	N	0	0.0	7	0	0.1	3	0	0.0	18	0	0.2	9	0	0.1
15	6	0	0.1	3	0	0.0	7	0	0.1	4	0	0.0	9	0	0.1	5	0	0.1
16	8	0	0.1	3	0	0.0	18	0	0.2	8	0	0.1	23	0	0.3	10	0	0.1
17	26	0	0.3	12	0	0.1	34	0	0.4	15	0	0.2	35	0	0.4	16	0	0.2
18	1	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0	10	0	0.1	4	0	0.0
19	N	0	0.0	N	0	0.0	27	0	0.3	13	0	0.1	30	0	0.4	15	0	0.2
20	N	0	0.0	N	0	0.0	8	0	0.1	5	0	0.0	13	0	0.1	8	0	0.1
21	N	0	0.0	N	0	0.0	20	0	0.2	8	0	0.1	29	0	0.3	13	0	0.1
22	N	0	0.0	N	0	0.0	15	0	0.2	7	0	0.1	23	0	0.3	10	0	0.1
23	23	0	0.3	9	0	0.1	34	0	0.4	15	0	0.2	35	0	0.4	15	0	0.2
24	14	0	0.1	5	0	0.1	20	0	0.2	8	0	0.1	21	0	0.2	8	0	0.1
25	N	0	0.0	N	0	0.0	7	0	0.1	2	0	0.0	7	0	0.1	2	0	0.0
26	12	0	0.1	5	0	0.0	18	0	0.2	7	0	0.1	18	0	0.2	7	0	0.1
27	6	0	0.1	2	0	0.0	17	0	0.2	7	0	0.1	17	0	0.2	7	0	0.1
28	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
30	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	6	0	0.1	3	0	0.0
31	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	14	0	0.2	6	0	0.1
32	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0	26	0	0.3	11	0	0.1
33	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	21	0	0.2	9	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	5	0	0.1	2	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	9	0	0.1	4	0	0.0
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	4	0	0.0
40	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0
41	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	7	0	0.1	4	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. ZONES WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

TABLE N24. -- PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS,
THE MOST LIKELY NUMBER OF SPILLS (MODE), AND THE EXPECTED NUMBER
OF SPILLS (MEAN) OCCURRING AND CONTACTING IMPACT ZONES
OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA.
TRACT DELETION ALTERNATIVE 3, USING TRANSPORTATION
SCENARIO C.

IMPACT ZONE	WITHIN 3 DAYS						WITHIN 10 DAYS						WITHIN 30 DAYS					
	≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.			≥ 1,000 BBLS.			≥ 10,000 BBLS.		
	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN	PROB	MODE	MEAN
2	N	0	0.0	N	0	0.0	8	0	0.1	4	0	0.0	14	0	0.2	7	0	0.1
3	N	0	0.0	N	0	0.0	25	0	0.3	14	0	0.2	27	0	0.3	15	0	0.2
4	20	0	0.2	11	0	0.1	35	0	0.4	20	0	0.2	35	0	0.4	20	0	0.2
5	27	0	0.3	14	0	0.2	36	0	0.4	20	0	0.2	36	0	0.4	20	0	0.2
6	9	0	0.1	2	0	0.0	13	0	0.1	4	0	0.0	14	0	0.2	5	0	0.1
7	10	0	0.1	3	0	0.0	16	0	0.2	5	0	0.1	22	0	0.2	8	0	0.1
8	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	23	0	0.3	11	0	0.1
9	6	0	0.1	2	0	0.0	20	0	0.2	10	0	0.1	25	0	0.3	13	0	0.1
10	N	0	0.0	N	0	0.0	5	0	0.0	1	0	0.0	22	0	0.2	10	0	0.1
11	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	24	0	0.3	10	0	0.1
12	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	23	0	0.3	10	0	0.1
13	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	2	0	0.0
14	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0	15	0	0.2	6	0	0.1
15	5	0	0.0	1	0	0.0	6	0	0.1	2	0	0.0	6	0	0.1	2	0	0.0
16	8	0	0.1	3	0	0.0	16	0	0.2	6	0	0.1	16	0	0.2	7	0	0.1
17	20	0	0.2	9	0	0.1	26	0	0.3	12	0	0.1	26	0	0.3	12	0	0.1
18	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
19	N	0	0.0	N	0	0.0	23	0	0.3	9	0	0.1	27	0	0.3	11	0	0.1
20	N	0	0.0	N	0	0.0	14	0	0.2	6	0	0.1	18	0	0.2	7	0	0.1
21	N	0	0.0	N	0	0.0	8	0	0.1	3	0	0.0	16	0	0.2	7	0	0.1
22	N	0	0.0	N	0	0.0	10	0	0.1	4	0	0.0	17	0	0.2	7	0	0.1
23	5	0	0.1	2	0	0.0	16	0	0.2	7	0	0.1	16	0	0.2	7	0	0.1
24	1	0	0.0	1	0	0.0	5	0	0.1	2	0	0.0	5	0	0.1	2	0	0.0
26	1	0	0.0	1	0	0.0	4	0	0.0	2	0	0.0	4	0	0.0	2	0	0.0
27	1	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0	3	0	0.0	1	0	0.0
31	N	0	0.0	N	0	0.0	1	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0
32	N	0	0.0	N	0	0.0	3	0	0.0	1	0	0.0	12	0	0.1	5	0	0.1
33	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	15	0	0.2	6	0	0.1
34	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	4	0	0.0	2	0	0.0
37	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	1	0	0.0	N	0	0.0
38	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	6	0	0.1	3	0	0.0
39	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	2	0	0.0	1	0	0.0
41	N	0	0.0	N	0	0.0	N	0	0.0	N	0	0.0	10	0	0.1	4	0	0.0

NOTE: N = LESS THAN 0.5 PERCENT; ** = GREATER THAN 99.5 PERCENT. ZONES WITH LESS THAN A 0.5 PERCENT PROBABILITY OF ONE OR MORE CONTACTS WITHIN 30 DAYS ARE NOT SHOWN

APPENDIX F

BLM/OCS ENVIRONMENTAL STUDIES PROGRAM

St. George Basin (Sale 70)

Prepared by
The Alaska OCS Office

St. George Basin (Sale 70)

RU	PI	TITLE	75	76	77	78	79	80	81	82
005	Feder, Howard	Distribution, Abundance, Community Structure, and Trophic Relationships of the Nearshore Benthos of the Kodiak Shelf, Cook Inlet, and Northeast Gulf of Alaska	X		X					
016	Davies, John Jacob, Klaus Bilham, Roger	A Seismotectonic Analysis of the Seismic and Volcanic Hazards in the Pribilof Islands-Eastern Aleutian Islands Region of the Bering Sea			X	X	X	X	X	X
029	Atlas, Ronald	Assessment of Potential Interactions of Microorganisms and Pollutants from Petroleum Development in Bering and Chukchi Seas						X	X	X
034	Ray, Carleton Wartzok, Douglas	Analysis of Marine Mammal Remote Sensing Data		X						
038	Hickey, Joseph	A Census of Seabirds on the Pribilof Islands	X	X						
047	Lafleur, Philip Hertz, H. S. Chesler, S. N. Basnes, I. L. Becker, D. A.	Environmental Assessment of Alaskan Waters - Trace Element Methodology - Inorganic Elements		X						
059	Hayes, Miles Boothroyd, Jon	Coastal Morphology, Sedimentation, and Oilspill Vulnerability of the Bristol Bay Coast						X		
067	Fiscus, Clifford Roppel, Alton	Baseline Characterization Marine Mammals	X	X						
068	Fiscus, Clifford Harry, George	Abundance and Seasonal Distribution of Marine Mammals in Gulf of Alaska						X	X	

RU	PI	TITLE	75	76	77	78	79	80	81	82
072	Karinen, John Rice, Stanley	Lethal and Sublethal Effects on Selected Alaskan Marine After Acute and Long-Term Exposure to Oil and Oil Components							X	X
073	Malins, Donald	Sublethal Effects of Petroleum Hydrocarbons Including Biotransformations, as Reflected by Morphology, Chemical, Physiological, Pathological, and Behavioral Indices							X	X
077	Leavastu, Taivo Favorite, Felix	Ecosystems Dynamics, Eastern Bering Sea		X		X				
078	Merrell, Theodore O'Clair, Charles	Littoral Studies: Gulf of Alaska and Bering Sea				X				
083	Hunt, George	Reproductive Ecology of Pribilof Island Seabirds	X	X		X	X	X	X	
087	Martin, Seelye	The Interaction of Oil with Sea Ice					X			
108	Wiens, John	Simulation Modeling of Marine Bird Population Energetics, Food Consumption, and Sensitivity to Perturbation				X				
140/ 146/ 149	Galt, Jerry	Numerical Studies of Alaskan Region		X	X		X			
141	Coachman, L. K. Schumacher, Jim	Bristol Bay Oceanographic Processes (B-BOP)			X	X	X			
153	Cline, Joel Feely, Richard	Sources, Composition and Dynamics of Natural and Petrogenic Light Hydrocarbons in Cook Inlet, Alaska		X				X	X	X
162	Burrell, David	Natural Distribution of Trace Heavy Metals and Environmental Background in 3 Alaskan Shelf Areas		X						

St. George (Sale 70)--Continued

RU	PI	TITLE	75	76	77	78	79	80	81	82
175	Pereyra, Walter	Summarize Existing Literature and Unpublished Data on the Distribution, Abundance, and Productivity of Demersal Fish, Shellfish, and Other Epibenthic Organisms	X	X						
194	Fay, Francis	Morbidity and Mortality of Key Marine Mammal Species				X				
206	Vallier, Tracy	Faulting and Slope Instability in the St. George Basin Area, and Immediately Adjacent Continental Shelf and Upper Continental Slope of the Southern Bering Sea	X	X	X		X			
209	Hopkins, David	Fault History of the Pribilof Islands and Its Relevance to Bottom Stability in St. George Basin	X	X						
217	Hansan, Donald	Langrangian Surface Current Measurements				X				
230	Burns, John	The Natural History and Ecology of the Bearded Seal, *Erignathus Barbatus* and the Ringed Seal, *Phoca (Pusa) Hispida*			X	X				
232	Lowry, Lloyd Burns, John	Trophic Relationships Among Ice-Inhabiting Phocid Seals and Functionally Related Marine Mammals			X		X			
248	Burns, John Fay, Francis Shapiro, Lewis	The Relationships of Marine Mammal Distributions, Densities, and Activities to Sea Ice Conditions			X	X				
251	Kienle, Jurgen Pulpan, Hans	Seismic and Volcanic Risk Studies -- Western Gulf of Alaska						X		

RU	PI	TITLE	75	76	77	78	79	80	81	82
257/ 258	Stringer, W. J.	Morphology of Beaufort, Chukchi and Bering Sea Nearshore Ice Condition by Means of Satellite and Aerial Remote Sensing				X				
267	Belon, Albert	Operation of an Alaskan Facility for Application of Remote - Sensing Data to OCS Studies			X		X			
275	Shaw, D. G.	Hydrocarbons: Natural Distribution and Dynamics on the Alaskan Outer Continental Shelf	X	X	X		X			
282/ 301	Feder, Howard	Summarization of Existing Literature and Unpublished Data on the Distribution, Abundance and Productivity of Benthic Organisms of the Gulf of Alaska and Bering Sea		X						
284	Smith, Ronald	Food and Feeding Relationships in the Benthic and Demersal Fishes of the Gulf of Alaska and the Bering Sea		X	X		X			
285	Morrow, James	Preparation of Illustrated Keys to Skeletal Remains and Otoliths of Forage Fishes - Gulf of Alaska and Bering Sea		X						
289	Royer, Thomas	Circulation of Water Masses in the Gulf of Alaska				X				
290/ 291	Hoskin, Charles	Grain Size Analysis of Sediment from Alaskan Continental Shelves			X		X			
332	McCain, Bruce	Determine the Incidence and Pathology of Marine Fish Diseases in the Gulf of Alaska, Bering Sea and Beaufort Sea		X						

St. George (Sale 70)--Continued

RU	PI	TITLE	75	76	77	78	79	80	81	82
337	Lensink, Cal Bartonek, James	Seasonal Distribution and Abundance of Marine Birds			X	X				
338	Lensink, Cal Bartonek, James	Photographic Mapping of Seabird Colonies		X						
339	Lensink, Cal	Review and Analysis of Literature and Unpublished Data on Marine Birds		X						
341	Lensink, Cal Bartonek, James	Feeding Ecology and Trophic Relationships of Alaskan Marine Birds		X			X			
342	Lensink, Cal	Population Dynamics of Marine Birds	X							
343	Lensink, Cal Bartonek, James	Preliminary Catalog of Seabird Colonies		X						
347	Searby, Harold Brower, Willaim	Marine Climatology of the Gulf of Alaska and the Bering and Beaufort Seas	X	X	X		X			
349	English, Tom	Alaska Marine Ichthyoplankton Key		X						
352	Meyers, Herb	Seismicity of the Beaufort Sea, Bering Sea and Gulf of Alaska		X						
353	Rogers, Donald Hartt, Allan	Determine and Describe the Present Status of Our Knowledge of the Distribution, Relative Abundance and Migratory Routes of Salmonids in the Gulf of Alaska North of 52N and West of 135W, and in the Bering Sea South of 60N and East of 175W			X					
367	Reynolds, Michael Walter, A. B.	Mesoscale Meteorology						X		
380	Waldron, K. D. Favorite, F.	Ichthyoplankton of the Eastern Bering Sea			X					

RU	PI	TITLE	75	76	77	78	79	80	81	82
427	Alexander, Vera Cooney, R. Ted	Ice-Edge Ecosystem Study: Primary Productivity, Nutrient Cycling, and Organic Matter Transport				X				
435	Leendertse, Jan	Modeling of Tides and Circulations of the Bering Sea (Phase IV)				X	X		X	X
480	Kaplan, I. R. Venkatesen, M. I.	Characterization of Organic Matter in Sediments from Gulf of Alaska, Bering and Beaufort Seas			X					
506	Robertson, D.	Major, Minor and Trace Element Analysis of Selected Bering Sea Sediment Samples by Instrumental Neutron Activation Analysis (INAA)			X	X				
549	Schumacher, James	Southeastern Bering Sea Oceanographic Processes				X	X	X	X	X
556	Dean, Walter	Trace Metals in the Bottom Sediments of the Southern Bering Sea				X	X			
586	Biswas, U/A	Compilation of Homogeneous Earthquake Catalog for the Alaska-Aleutian Region						X	X	
594	Baker	Suspended Particulate Matter Distribution and Transport							X	X
595	Griffiths	Microbial Processes as Related to Transport in the North Aleutian Shelf and St. George Lease Areas						X	X	
596	Overland	Southeast Bering Sea Meteorological Processes						X	X	X
597	Payne	Oil Weathering Experiments - Sub-Arctic							X	X

St. George (Sale 70)--Continued

PU	PI	TITLE	75	76	77	78	79	80	81	82
609	Armstrong D.	Benthic Ecosystem Study: Taxonomic Composition, Seasonal Distribution, and Abundance of Decapod Larvae in the Bering Sea							X	X
611	Fay, F. H.	Modern Populations, Migrations, Demography, Trophics, and Historical Status of the Pacific Walrus in Alaska							X	X
614	AFO; Curl, H.	North Aleutian/St. George Transport Study - Central and Northern Bering Sea							X	X
1014	Fay, U/A, IMS	Modern Populations, Migrations, Demography, Trophics, and Historical Status of the Pacific Walrus in Alaska							X	
1021	AFO	Effects of Petroleum on Ecological Processes of the Southern Bering Sea							X	
1025	AFO	Taxonomic compositons, Seasonal Distribution, and Abundance of Decapod Larvae in the Eastern Bering Sea							X	
2009		Feeding Ecology of King and Tanner Crab Juveniles in the Bering Sea							X	X
2013	Holmes, W. N.	Determination of the Threshold Concentration of Ingested Petroleum Necessary to Irreversibly Alter Reproductive Success in Ducks.							X	X
2034		Aerial Surveys of Endangered Whales in the Southern Bering Sea and Northern Gulf of Alaska Regions								X

APPENDIX G

EMPLOYMENT AND POPULATION IMPACTS
ON SELECTED COMMUNITIES

Prepared by
The Alaska OCS Office

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Table G-1
OCS Employment and Population Impacts[1]
Community of St. Paul
(South Shore Terminal Site Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment					Categories of Workers in OCS Impact Jobs				OCS Population Impact	
								Old Census Division Residents from:			
Year	Direct	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	Commuters	New Residents of Census Div.	This Town	Other Towns	Residents Only	Including Commuters
1983	6	2	1	9	6	3	3	3	0	3	6
1984	9	3	2	14	10	4	5	5	0	6	10
1985	11	6	4	21	15	6	7	8	0	8	14
1986	9	14	5	28	24	4	12	12	0	15	19
1987	5	25	7	37	35	2	18	17	0	23	25
1988	0	20	5	25	25	0	13	12	0	18	18
1989	0	13	4	17	17	0	9	8	0	13	13
1990	0	7	2	9	9	0	4	5	0	6	6
1991	0	5	2	7	7	0	4	3	0	6	6
1992	0	6	2	8	8	0	4	4	0	6	6
...											
2011	0	5	2	7	7	0	3	4	0	5	5
2012	0	2	1	3	3	0	2	1	0	3	3
...											
2019	0	2	1	3	3	0	2	1	0	3	3

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[1] Definitions of terms used in the column headings are as follows:

Column (1): Includes all direct OCS petroleum development jobs in this community. Also includes OCS jobs offshore and in uninhabited locations onshore (enclaves) filled by workers who reside in this community.

Column (2): Refers principally to jobs created by the movement of OCS manpower and materials into and out of the area. These jobs include employment in air transportation and employment in hotels and restaurants. Very small amounts of other types of employment are also included, such as jobs in communications services utilized in OCS activities. Not included in this category are jobs involved in transporting oil and gas to market, since these jobs are included in column (1) figures for OCS direct employment.

Column (3): Includes all jobs in retail trade, or other job classifications, which are created by the personal consumption expenditures of workers in direct and indirect OCS jobs (columns 1 and 2). Also includes government jobs, principally local government, resulting from demand for government services generated by workers in direct and indirect OCS jobs and their families.

Column (4): The sums of figures in Columns (1), (2), and (3). Also equal to the sums of columns (6), (7), (8), and (9).

Column (5): The sums of figures in columns (1), (2), and (3) minus the figures in column (6). Also equal to the sums of columns (7), (8), and (9).

Column (6): These figures represent all workers in direct OCS jobs in the community who do not maintain a residence within the community, and who commute to residences outside the census division during periods of rest and recreation.

Column (7): Includes newly arrived residents in all three categories of OCS impact jobs (direct, indirect, and induced) who have migrated from places outside the census division. These workers maintain a local residence, and do not commute to other areas during rest and recreation periods. Includes OCS workers in jobs offshore or in uninhabited locations onshore (enclaves) who maintain a permanent residence within this community.

Column (8): Includes only those workers who would have resided within this community in the absence of OCS activity, and who become employed in OCS impact jobs, including direct, indirect, or induced.

Column (9): Includes newly arrived residents in all three categories of OCS impact jobs (direct, indirect, and induced) who have migrated to this community from other communities within the census division.

Column (10): These population figures represent all OCS impact workers who are new residents of the community (columns 7 and 9) together with their dependents.

Column (11): Although OCS workers who commute to residences outside the census division are not considered residents, those OCS commuters whose jobs are in settled communities do have significant economic and social impacts on the communities in which they work. Figures in this column are the sums of the resident population impact figures in column (10) plus OCS commuters with jobs in this community.

Source: Alaska OCS Office, 1981 (unpublished).

Table G-2
OCS Employment and Population Impacts[1/]
Community of Unalaska/Dutch Harbor
(South Shore Terminal Site Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment					Categories of Workers in OCS Impact Jobs				OCS Population Impact	
								Old Census Division Residents from:			
Year	Direct	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	Commuters	New Residents of Census Div.	This Town	Other Towns	Residents Only	Including Commuters
1983	166	0	33	199	196	3	133	50	13	161	164
1984	287	0	63	350	342	8	242	50	50	336	344
1985	419	0	101	520	490	30	390	50	50	528	558
1986	272	0	71	343	303	40	203	50	50	316	356
1987	268	0	75	343	262	81	162	50	50	276	357
1988	235	0	71	306	205	101	105	50	50	209	310
1989	298	0	95	393	281	112	181	50	50	323	435
1990	216	0	73	289	226	63	126	50	50	255	318
1991	216	0	78	294	231	63	131	50	50	272	335
1992	216	0	88	304	241	63	141	50	50	296	359
...											
2011	216	0	108	324	261	63	161	50	50	380	443
2012	180	0	90	270	207	63	107	50	50	283	346
...											
2019	180	0	90	270	207	63	107	50	50	283	346

1/ For definitions of terms used in the column headings above, see footnote following Table G-1.

Source: Alaska OCS Office, 1981 (unpublished).

Table G-3
OCS Employment and Population Impacts[1/]
Community of Cold Bay
(South Shore Terminal Site Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment					Categories of Workers in OCS Impact Jobs				OCS Population Impact	
								Old Census Division Residents from:			
Year	Direct	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	Commuters	New Residents of Census Div.	This Town	Other Towns	Residents Only	Including Commuters
1983	39	12	10	61	45	16	25	0	20	50	66
1984	71	20	20	111	86	25	61	0	25	99	124
1985	142	44	45	231	176	55	151	0	25	211	266
1986	156	89	64	309	213	96	188	0	25	266	362
1987	286	225	143	654	492	162	467	0	25	640	802
1988	340	204	163	707	521	186	496	0	25	703	889
1989	393	174	182	749	543	206	518	0	25	760	966
1990	247	116	124	487	371	116	346	0	25	538	654
1991	226	52	100	378	262	116	237	0	25	393	509
1992	226	58	108	392	276	116	251	0	25	428	544
...											
2011	226	51	139	416	300	116	275	0	25	540	656
2012	211	29	120	360	244	116	219	0	25	440	556
...											
2019	211	29	120	360	244	116	219	0	25	440	556

1/ For definitions of terms used in the column headings above, see footnote following Table G-1.

Source: Alaska OCS Office, 1981 (unpublished).

Table G-4
OCS Employment and Population Impacts[1/]
Community of St. Paul
(St. Paul Terminal Site Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment					Categories of Workers in OCS Impact Jobs				OCS Population Impact	
								Old Census Division Residents from:			
Year	Direct	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	Commuters	New Residents of Census Div.	This Town	Other Towns	Residents Only	Including Commuters
1983	34	2	6	42	36	6	27	9	0	30	36
1984	92	3	17	112	99	13	74	25	0	85	98
1985	200	21	44	265	228	37	164	64	0	197	234
1986	76	48	27	151	103	48	53	50	0	66	114
1987	1,641	87	415	2,143	611	1,532	506	80	25	690	2,222
1988	1,890	71	510	2,471	722	1,749	617	80	25	867	2,616
1989	2,128	51	610	2,789	830	1,959	725	80	25	1,050	3,009
1990	1,604	29	490	2,123	650	1,473	545	80	25	827	2,300
1991	575	20	190	785	321	464	216	80	25	362	826
1992	575	23	203	801	337	464	232	80	25	386	850
...											
2011	575	19	297	891	427	464	322	80	25	521	985
2012	440	8	224	672	316	356	211	80	25	354	710
...											
2019	440	8	224	672	316	356	211	80	25	354	710

1/ For definitions of terms used in the column headings above, see footnote following Table G-1.

Source: Alaska OCS Office, 1981 (unpublished).

Table G-5
OCS Employment and Population Impacts[1/]
Community of Unalaska/Dutch Harbor
(St. Paul Terminal Site Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment					Categories of Workers in OCS Impact Jobs				OCS Population Impact	
								Old Census Division Residents from:			
Year	Direct	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	Commuters	New Residents of Census Div.	This Town	Other Towns	Residents Only	Including Commuters
1983	147	0	29	176	175	1	120	30	25	160	161
1984	232	0	51	283	280	3	215	40	25	276	279
1985	300	0	72	372	357	15	282	50	25	386	383
1986	249	0	65	314	287	27	212	50	25	296	323
1987	200	0	56	256	202	54	127	50	25	198	252
1988	112	0	34	146	78	68	38	40	0	51	119
1989	125	0	40	165	90	75	45	45	0	63	138
1990	70	0	24	94	52	42	26	26	0	38	80
1991	70	0	25	95	53	42	26	27	0	39	81
1992	70	0	27	97	55	42	28	27	0	43	85
...											
2011	70	0	35	105	63	42	31	32	0	56	98
2012	70	0	35	105	63	42	31	32	0	56	98
...											
2012	70	0	35	105	63	42	31	32	0	56	98

1/ For definitions of terms used in the column headings above, see footnote following Table G-1.

Source: Alaska OCS Office, 1981 (unpublished).

Table G-6
OCS Employment and Population Impacts[1/]
Community of Cold Bay
(St. Paul Terminal Site Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment					Categories of Workers in OCS Impact Jobs				OCS Population Impact	
								Old Census Division Residents from:			
Year	Direct	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	Commuters	New Residents of Census Div.	This Town	Other Towns	Residents Only	Including Commuters
1983	30	12	8	50	35	15	17	0	18	39	54
1984	43	19	14	76	54	22	29	0	25	62	84
1985	72	35	26	133	92	41	67	0	25	110	151
1986	110	64	45	219	147	72	122	0	25	184	256
1987	160	132	82	374	260	114	235	0	25	338	452
1988	169	100	81	350	223	127	198	0	25	301	428
1989	188	89	88	365	224	141	199	0	25	314	455
1990	105	58	55	218	139	79	114	0	25	202	281
1991	105	30	48	183	104	79	79	0	25	156	235
1992	105	33	53	191	112	79	87	0	25	174	253
...											
2011	105	29	67	201	122	79	97	0	25	220	299
2012	105	15	60	180	101	79	76	0	25	182	261
...											
2019	105	15	60	180	101	79	76	0	25	182	261

1/ For definitions of terms used in the column headings above, see footnote following Table G-1.

Source: Alaska OCS Office, 1981 (unpublished).

Table G-7
OCS Employment and Population Impacts[1/]
Community of St. Paul
(Makushin Bay Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment					Categories of Workers in OCS Impact Jobs				OCS Population Impact	
								Old Census Division Residents from:			
Year	Direct	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	Commuters	New Residents of Census Div.	This Town	Other Towns	Residents Only	Including Commuters
1983	6	2	1	9	6	3	2	4	0	2	5
1984	9	3	2	14	9	5	3	6	0	3	8
1985	15	6	4	25	17	8	3	14	0	4	12
1986	13	14	5	33	26	7	3	23	0	4	11
1987	9	28	9	46	41	5	2	39	0	3	8
1988	4	23	7	34	32	2	1	31	0	1	3
1989	4	13	5	22	20	2	2	18	0	3	5
1990	4	7	3	14	12	2	0	12	0	0	2
1991	4	5	3	12	10	2	1	9	0	2	4
1992	4	6	3	13	11	2	1	10	0	2	4
...											
2011	4	5	4	13	11	2	1	10	0	2	4
2012	4	2	3	9	7	2	1	6	0	2	4
...											
2019	4	2	3	9	7	2	1	6	0	2	4

1/ For definitions of terms used in the column headings above, see footnote following Table G-1.

Source: Alaska OCS Office, 1981 (unpublished).

Table G-8
OCS Employment and Population Impacts[1/]
Community of Unalaska/Dutch Harbor
(Makushin Bay Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment					Categories of Workers in OCS Impact Jobs				OCS Population Impact	
								Old Census Division Residents from:			
Year	Direct	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	Commuters	New Residents of Census Div.	This Town	Other Towns	Residents Only	Including Commuters
1983	175	0	35	210	206	4	141	50	15	172	176
1984	315	0	69	384	373	11	273	50	50	371	382
1985	499	0	120	619	569	50	469	50	50	623	673
1986	345	0	90	435	350	85	250	50	50	375	460
1987	452	48	140	640	470	170	370	50	50	546	716
1988	523	54	173	750	538	212	438	50	50	659	871
1989	672	55	233	960	724	236	624	50	50	944	1,180
1990	491	42	181	714	582	132	482	50	50	771	903
1991	470	15	175	660	528	132	428	50	50	717	849
1992	470	17	185	672	540	132	440	50	50	760	892
...											
2011	470	15	242	727	595	132	495	50	50	981	1,113
2012	395	8	201	604	472	132	372	50	50	760	892
...											
2019	395	8	201	604	472	132	372	50	50	760	892

1/ For definitions of terms used in the column headings above, see footnote following Table G-1.

Source: Alaska OCS Office, 1981 (unpublished).

Table G-9
OCS Employment and Population Impacts[1/]
Community of Cold Bay
(Makushin Bay Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment					Categories of Workers in OCS Impact Jobs				OCS Population Impact	
								Old Census Division Residents from:			
Year	Direct	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	Commuters	New Residents of Census Div.	This Town	Other Towns	Residents Only	Including Commuters
1983	30	10	8	48	33	15	16	0	17	36	51
1984	43	17	13	73	51	22	26	0	25	59	81
1985	58	41	24	123	92	31	67	0	25	110	141
1986	78	88	43	209	162	47	137	0	25	203	250
1987	98	186	79	363	296	67	271	0	25	385	452
1988	92	159	75	326	257	69	232	0	25	347	416
1989	103	123	72	298	221	77	196	0	25	309	386
1990	56	74	44	174	132	42	107	0	25	191	233
1991	56	37	33	126	84	42	59	0	25	126	168
1992	56	41	37	134	92	42	67	0	25	143	185
...											
2011	56	36	46	138	16	42	71	0	25	173	215
2012	56	20	38	114	72	42	47	0	25	130	172
...											
2019	56	20	38	114	72	42	47	0	25	130	172

1/ For definitions of terms used in the column headings above, see footnote following Table G-1.

Source: Alaska OCS Office, 1981 (unpublished).

Table G-10
OCS Employment and Population Impacts[1/]
Community of St. Paul
(Offshore Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment					Categories of Workers in OCS Impact Jobs				OCS Population Impact	
								Old Census Division Residents from:			
Year	Direct	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	Commuters	New Residents of Census Div.	This Town	Other Towns	Residents Only	Including Commuters
1983	6	2	1	9	6	3	3	3	0	3	6
1984	9	3	2	14	10	4	5	5	0	6	10
1985	13	10	5	28	21	7	11	10	0	13	20
1986	16	25	9	50	40	10	20	20	0	25	35
1987	18	46	16	80	67	13	34	33	0	44	57
1988	17	40	15	72	59	13	31	28	0	42	55
1989	19	31	14	64	50	14	27	23	0	38	52
1990	10	20	9	39	31	8	16	15	0	23	31
1991	10	17	9	36	28	8	15	13	0	23	31
1992	10	17	9	36	28	8	14	14	0	21	29
...											
2011	10	15	13	38	30	8	16	14	0	24	32
2012	10	8	9	27	19	8	10	9	0	15	23
...											
2019	10	8	9	27	19	8	10	9	0	15	23

[1/] For definitions of terms used in the column headings above, see footnote following Table G-1.

Source: Alaska OCS Office, 1981 (unpublished).

Table G-11
OCS Employment and Population Impacts[1/]
Community of Unalaska/Dutch Harbor
(Offshore Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment					Categories of Workers in OCS Impact Jobs				OCS Population Impact	
								Old Census Division Residents from:			
Year	Direct	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	Commuters	New Residents of Census Div.	This Town	Other Towns	Residents Only	Including Commuters
1983	175	0	35	210	206	4	140	30	36	194	198
1984	315	0	69	384	373	11	283	40	50	383	394
1985	497	0	119	616	567	49	467	50	50	620	669
1986	339	0	88	427	346	81	246	50	50	370	451
1987	410	0	115	525	363	162	263	50	50	407	569
1988	368	0	110	478	276	202	176	50	50	305	507
1989	405	0	130	535	310	225	210	50	50	364	589
1990	240	0	82	322	196	126	110	50	36	212	338
1991	240	0	86	326	200	126	112	50	38	225	351
1992	240	0	91	331	205	126	115	50	40	240	366
...											
2011	240	0	120	360	234	126	134	50	50	331	457
2012	225	0	112	337	211	126	114	50	47	290	416
...											
2012	225	0	112	337	211	126	114	50	47	290	416

[1/] For definitions of terms used in the column headings above, see footnote following Table G-1.

Source: Alaska OCS Office, 1981 (unpublished).

Table G-12
OCS Employment and Population Impacts[1/]
Community of Cold Bay
(Offshore Scenario)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OCS Impact Employment					Categories of Workers in OCS Impact Jobs					
								Old Census Division Residents from:		OCS Population Impact	
Year	Direct	Indirect	Induced	Total, Including Commuters	Total, Excluding Commuters	Commuters	New Residents of Census Div.	This Town	Other Towns	Residents Only	Including Commuters
1983	30	12	8	50	35	15	17	0	18	39	54
1984	43	20	14	77	55	22	30	0	25	63	85
1985	62	35	23	120	86	34	61	0	25	103	137
1986	81	64	38	183	133	50	108	0	25	166	216
1987	102	111	60	273	203	70	178	0	25	264	334
1988	96	93	57	246	174	72	149	0	25	235	307
1989	106	62	54	222	142	80	117	0	25	199	279
1990	60	40	34	134	89	45	64	0	25	129	174
1991	60	31	32	123	78	45	53	0	25	117	162
1992	60	34	36	130	85	45	60	0	25	132	177
...											
2011	60	30	45	135	90	45	65	0	25	162	207
2012	60	16	38	114	69	45	45	0	25	126	171
...											
2019	60	16	38	114	69	45	45	0	25	126	171

1/ For definitions of terms used in the column headings above, see footnote following Table G-1.

Source: Alaska OCS Office, 1981 (unpublished).

Table G-13
Comparison of Future Employment and Population - With and Without Proposed St. George Basin OCS Development
Community of St. Paul

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Projected Employment					Projected Population				
		Future Employment with OCS Development (Figures Exclude all OCS Commuters)					Future Population with OCS Development (Figures Exclude all OCS Commuters)			
Year	Non-OCS Scenario Employment (Incl. Non-Residents)[1]	Offshore Scenario	St. Paul Terminal Scenario	Mackushin Bay Scenario	South Shore Scenario	Non-OCS Scenario Resident Population[2]	Offshore Scenario	St. Paul Terminal Scenario	Makushin Bay Scenario	South Shore Scenario
1980	123	Same	Same	Same	Same	551	Same	Same	Same	Same
1985	131	152	359	148	146	551	564	748	555	559
1990	956	987	1,606	968	965	1,423	1,446	2,250	1,423	1,429
1995	956	985	1,307	967	963	1,423	1,445	1,830	1,425	1,428
2000	978	1,007	1,353	989	985	1,423	1,446	1,866	1,425	1,428
		Future Employment with OCS Development (Incl. OCS Commuters with Jobs in Town)					Future Population with OCS Development (Incl. OCS Commuters with Jobs in Town)			
1980	123	Same	Same	Same	Same	551	Same	Same	Same	Same
1985	131	159	396	156	152	551	571	785	563	565
1990	956	995	3,079	970	965	1,423	1,454	3,723	1,425	1,429
1995	956	993	1,771	969	963	1,423	1,453	2,294	1,427	1,428
2000	978	1,015	1,817	991	985	1,423	1,454	2,330	1,427	1,428

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[1] Figures for Non-OCS Scenario Employment include non-resident fishermen and fish processing workers.

[2] Figures for Non-OCS Scenario Resident Population exclude non-resident fishermen and fish processing workers.

Sources: The employment figure for 1980 and the employment and population projections for the non-OCS future are those prepared by Alaska Consultants, Inc., 1981, OCS Technical Report No. 59. Figures for employment and population impacts expected from OCS development in the St. George Basin were prepared by the Alaska OCS Office. The U.S. Census Bureau published the 1980 population figures.

Table G-14
Comparison of Future Employment and Population - With and Without Proposed St. George Basin OCS Development
Community of Unalaska/Dutch Harbor

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Projected Employment					Projected Population				
	Non-OCS Scenario Employment (Incl. Non-Residents)1/	Future Employment with OCS Development (Figures Exclude all OCS Commuters)				Non-OCS Scenario Resident Population2/	Future Population with OCS Development (Figures Exclude all OCS Commuters)			
Year		Offshore Scenario	St. Paul Terminal Scenario	Mackushin Bay Scenario	South Shore Scenario		Offshore Scenario	St. Paul Terminal Scenario	Makushin Bay Scenario	South Shore Scenario
1980	1,600	Same	Same	Same	Same	1,301	Same	Same	Same	Same
1985	2,661	3,228	3,018	3,230	3,151	2,945	3,565	3,313	3,568	3,473
1990	4,780	4,976	4,832	5,362	5,006	6,280	6,492	6,318	7,051	6,535
1995	7,425	7,635	7,481	7,974	7,669	10,586	10,840	10,631	11,381	10,895
2000	8,967	9,184	9,025	9,530	9,216	13,221	13.499	13,269	14,074	13,552
		Future Employment with OCS Development (Incl. OCS Commuters with Jobs in Town)					Future Population with OCS Development (Incl. OCS Commuters with Jobs in Town)			
1980	1,600	Same	Same	Same	Same	1,301	Same	Same	Same	Same
1985	2,661	3,277	3,033	3,280	3,181	2,945	3,614	3,328	3,618	3,503
1990	4,780	5,102	4,874	5,494	5,069	6,280	6,618	6,360	7,183	6,598
1995	7,425	7,761	7,523	8,106	7,732	10,586	10,966	10,673	11,513	10,958
2000	8,967	9,310	9,067	9,662	9,279	13,221	13,625	13,311	14,206	13,615

1/ Figures for Non-OCS Scenario Employment include non-resident fishermen and fish processing workers.

2/ Figures for Non-OCS Scenario Resident Population exclude non-resident fishermen and fish processing workers.

Sources: The employment figure for 1980 and the employment and population projections for the non-OCS future are those prepared by Alaska Consultants, Inc., 1981, OCS Technical Report No. 59. Figures for employment and population impacts expected from OCS development in the St. George Basin were prepared by the Alaska OCS Office. The U.S. Census Bureau published the 1980 population figures.

Table G-15
Comparison of Future Employment and Population - With and Without Proposed St. George Basin OCS Development
Community of Cold Bay

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Projected Employment					Projected Population			
	Non-OCS Scenario Employment (Incl. Non-Residents)1/	Future Employment with OCS Development (Figures Exclude all OCS Commuters)				Non-OCS Scenario Resident Population2/	Future Population with OCS Development (Figures Exclude all OCS Commuters)			
Year		Offshore Scenario	St. Paul Terminal Scenario	Mackushin Bay Scenario	South Shore Scenario		Offshore Scenario	St. Paul Terminal Scenario	Makushin Bay Scenario	South Shore Scenario
1980	200	Same	Same	Same	Same	226	Same	Same	Same	Same
1985	244	330	336	336	420	332	435	442	442	543
1990	306	395	445	438	677	422	551	624	613	960
1995	382	468	496	475	662	531	668	712	679	977
2000	461	549	577	555	747	646	791	839	802	1,121
		Future Employment with OCS Development (Incl. OCS Commuters with Jobs in Town)					Future Population with OCS Development (Incl. OCS Commuters with Jobs in Town)			
1980	200	Same	Same	Same	Same	226	Same	Same	Same	Same
1985	244	364	377	367	475	332	469	483	473	598
1990	306	440	524	480	793	422	596	703	655	1,076
1995	382	513	575	515	778	531	713	791	721	1,093
2000	461	594	656	595	863	646	836	918	844	1,237

1/ Figures for Non-OCS Scenario Employment include non-resident fishermen and fish processing workers.

2/ Figures for Non-OCS Scenario Resident Population exclude non-resident fishermen and fish processing workers.

Sources: The employment figure for 1980 and the employment and population projections for the non-OCS future are those prepared by Alaska Consultants, Inc., 1981, OCS Technical Report No. 59. Figures for employment and population impacts expected from OCS development in the St. George Basin were prepared by the Alaska OCS Office. The U.S. Census Bureau published the 1980 population figures.

APPENDIX H

ALTERNATIVE ENERGY SOURCES AS AN ALTERNATIVE TO THE OCS PROGRAM

Prepared by
The Alaska OCS Office

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To delay or eliminate, in part or in whole, the proposed sale would reduce future OCS oil and gas production, necessitate escalated imports of oil and gas, and/or require the development of alternate energy sources to replace the energy resources expected to be recovered if the proposed sale takes place.

The oil and gas that could become available from the proposal over the time period could add to national domestic production. If this proposed sale is cancelled, an additive impact of greater oil and gas deficits resulting in increased imports can be expected. If the subject sale were cancelled, the following energy actions or sources might be used as substitutes. However, some of these actions are not feasible at this time and may not be during the estimated life of this production area.

It is anticipated that the oil and gas that would become available from this proposal in the time period could provide significant contribution to this region's energy supply; if the subject sale were cancelled, the following energy actions or sources might be used as substitutes:

-Energy conservation
-Conventional oil and gas supplies
-Coal
-Nuclear power - fission
-Nuclear power - fusion
-Oil shale
-Tar sands
-Hydroelectric power
-Solar energy
-Energy imports
    Oil imports
    Natural gas pipeline imports
    Liquefied natural gas imports
-Geothermal energy
-Other energy sources
-Combination of alternatives

This section briefly discusses these alternatives. For more detailed information on each of these energy sources and environmental impacts, refer to Energy Alternatives: A Comparative Analysis (University of Oklahoma, 1975), prepared for the Bureau of Land Management by the Science and Public Policy Program of the University of Oklahoma.

Energy Conservation: Vigorous energy conservation is an alternative that warrants serious consideration. Several studies have suggested that we could enjoy the same standard of living and yet use 30 to 50 percent less energy than we do now (Lansberg et al., 1979). Aside from these savings, it is now widely recognized that wasteful consumption habits impose social costs that can no longer be afforded, as do pollution and an inequitable distribution of fuel. Existing conservation programs include education, research and development, regulation, and subsidies.

The residential and commercial sectors of the economy are often characterized as inefficient energy consumers. Inadequate insulation, inefficient heating and cooling systems, poorly designed appliances, and excessive lighting are often noticed in these sectors. Reductions in consumption beyond those induced by fuel price increases could be achieved by new standards on products and building and/or subsidies and incentives. Such incentives include standards for improved thermal efficiency in existing homes and offices and minimum thermal standards for new homes and offices.

Excessive consumption is also evident in the industrial sector where energy inefficient work schedules, poorly maintained equipment, use of equipment with extremely low heat transfer efficiencies, and failure to recycle heat and waste materials are all commonplace.

Transportation of people and goods accounts for approximately 25 percent of nationwide energy use. Energy inefficiency in the transportation sector varies directly with automobile usage. Automobiles, which account for the bulk of all passenger movement in the nation, use more than twice as much energy per passenger mile as buses. Using short- and mid-term conservation measures such as consumer education, lower speed limits, and rate and service improvements on public transit and rail freight transit may achieve considerable energy savings.

Other policies which could encourage fuel conservation in transportation include standards for more efficient new automobiles and incentives to reduce miles traveled. An important new development in the fuel economy area could be the modification of the standard internal combustion engine. Although such an engine is now in the advanced stages of development, further study by automotive engineers, industry, and concerned Federal agencies is necessary before an acceptable engine may be designed.

Significant energy savings are clearly possible through accelerated conservation efforts. In addition, several of the strategies mentioned above have been at least partially implemented by the Energy Policy and Conservation Act of 1975 (P.L. 94-163).

Environmental Impact: The environmental impacts of a vigorous energy conservation program will be primarily beneficial. The exact nature and magnitude of these impacts will depend on whether there is a net reduction in energy use or whether the reduction is accomplished through technological change and substitutions. For the former, the net impacts will simply be that there are fewer pollutants of all kinds unleashed. As an example, a 2.2 million barrel/day savings would result in a diminishment nationwide of various pollutants by the following amounts (HUD Contract #H2026R: "Research Evaluation of a System of Natural Air Conditioning").

CO--4 lbs/1,000 gals = 189 tons/day
Hydrocarbons--3 lbs/1,000 gals = 142 tons/day
Particulates--23 lbs/1,000 gals = 1,088 tons/day
NO_x--60 lbs/1,000 gals = 2,838 tons/day
SO_2--157 lbs/1,000 gals = 7,426 tons/day

However, if energy conservation is achieved by technological change or substitution, the net reductions will be those above. Other impacts will be related or attributed to an OCS lease sale in another unidentified area or as described below.

Conventional Oil and Gas Supplies: Large quantities of oil and gas still remain in the United States. Between 1955 and 1969, the U.S. had slightly increasing amounts of proved oil reserves at about 30 billion barrels. The discovery at Prudhoe Bay in 1970 raised the amount to 40 billion, which has been declining ever since. Since 1970 new oil discoveries have replaced less than half of production. Reserves are currently at the lowest level since 1951. U.S. production has been fairly constant since the mid-60's at 8 to 9 million barrels daily. Similar patterns occur for natural gas. Proved reserves are currently estimated at 31.4 billion barrels of oil and 208.0 trillion cubic feet of natural gas.

Ultimately recoverable resources (all deposits known or believed to exist in such forms that economic extraction is currently or potentially feasible), in addition to proved reserves, are estimated to be about 82.6 billion barrels of oil (54.6 onshore/28.0 offshore), 13 years of consumption at current rates, and 593.9 trillion cubic feet of natural gas (426.9 onshore/167.0 offshore). This estimate is rising over time, mainly because of higher prices, and much is unexplored. Unconventional hydrocarbons and recovery methods, especially enhanced recovery, could more than double these figures. The amount of ultimately recoverable reserves will depend on price, technology, geological information, and public policy such as price controls, access to Federal lands, and environmental standards.

Petroleum production is severely constrained in the short-run, and greatly affected by world prices in the long-run. Although the long-run demand for fuel liquids is not forecast to decline significantly (feasible solid and gaseous substitutes do not appear to exist), consumption of conventional crude oil is expected to decline significantly, as synthetic liquids are produced from shale, tar sands, coal, and biomass, and industry and utilities retire oil facilities and shift to coal and nuclear (see Table H-5). Synthetic liquid from coal is expected to be the major source of liquid fuel by 2020, supplying 50 percent of all liquid fuel and 10 percent of all energy consumed.

The following table displays the dimensions of the projected decline in conventional crude oil demand (see Table H-5):

	1980	2020
Quads of Conventional Crude Oil Consumed	34	8
As Percentage of Total Energy Consumption	45%	6%
Quads of Liquid Fuel Consumed	34	30
As Percentage of Total Energy Consumed	45%	21%

Conventional natural gas consumption is expected to decline due to depletion, higher prices, and competition with synthetic gas from coal. Enhanced gas recovery from unconventional sources such as tight sands and Devonian shale is expected to make a significant contribution to gaseous fuel production, providing 50 percent of all gaseous fuel and 5 percent of all energy consumption by 2020. Ultimately recoverable reserves from such sources are estimated at 3,000 trillion cubic feet. The following table displays the dimensions of the projected decline in gaseous fuel demand (see Table H-5):

	1980	2020
Quads of Conventional Natural Gas Consumed	20	6
As Percentage of Total Energy Consumption	26%	4%
Quads of Gaseous Fuel Consumed	20	15
As Percentage of Total Energy Consumption	26%	11%

A detailed description of the crude oil and natural gas systems is found in Chapters 3 and 4 of Energy Alternatives: A Comparative Analysis.

To substitute directly for the subject sale, a combination of onshore and OCS production from other areas and continued foreign imports would be required to make up for the estimated total production of this proposed sale.

Environmental Impact: This substitution would entail environmental impacts such as land subsidence, soil sterilization, and disruption of existing land use patterns. Equipment failure, human error, and blowouts may also impair environmental quality. Moreover, poor well construction, particularly in older wells, and oilspills can result in ground and surface water pollution.

The water pollutants from onshore oil production are oil and dissolved solids. The amounts of each vary over a wide range. A summary of this is available in Energy Alternative: A Comparative Analysis.

Air pollutants (particulates, NO_x, hydrocarbons, and CO) result from blowouts and subsequent evaporation and burning. These are generally insignificant, except locally. These effects will be basically the same, whether the production is onshore or offshore.

Given the fact that onshore supplies are dwindling, users of hydrocarbons from this proposal would have to continue their reliance on other regions and foreign imports for needed oil and gas. The decline in these supplies, even with energy conservation, could mean industrial shutdowns, increased unemployment, higher consumer prices, and changes in the standard of living. The lack of natural gas will mean additional use of "dirtier" alternative fuels (oil, coal) with consequent impacts on air quality and human health.

Coal: Coal is the most abundant energy resource in the United States. Proved domestic reserves of coal are estimated at 438 billion short tons. This constitutes over one-quarter of known world supply, 80 percent of U.S. proven fuel reserves, and 130 times the energy consumed in 1980. Ultimately recoverable reserves are estimated at 3,900 billion short tons. A detailed discussion of the coal resource system can be found in Chapter 1 of Energy Alternatives: A Comparative Analysis.

Coal production (18.88 quads), consumption (15.67 quads), and inventories (203.6 million short tons) were at record levels in 1980, mostly as a result of increased demand from the electric utilities, including the conversion of existing power generating units from oil to coal. The 7 percent increase in coal production over 1979 is the main reason for the U.S.'s record energy production in 1980.

Though domestic coal reserves could easily replace the energy expected to be realized from the proposed sale, serious limitations to coal development exist. In many uses, coal is an imperfect substitute for oil or natural gas. In many other cases, coal use and production is restricted by government constraints, limited availability of low sulfur deposits, inadequate mining, conversion and pollution abatement technology, and the hazardous environmental impacts associated with coal extraction and electricity generated from coal. Coal production is also threatened by the unique set of labor problems associated with mining and new, strict standards for coal-mine safety.

Due to its relative price advantage over other fuels, competitive market structure, and large resource base, coal consumption and production are expected to increase significantly and become the primary domestic energy source (see Table H-5). Synfuels from coal will also be important (see below).

The Powerplant and Industrial Fuel Use Act of 1978 was designed to reduce petroleum and natural gas consumption and to encourage greater use of coal and alternative fuels. The Act prohibits all new electric powerplants and large industrial boilers, and existing ones after 1990, from consuming oil or natural gas as a primary fuel source unless an exemption is granted.

Although U.S. coal resources are very large, as with other extractable mineral fuels, there is some geographic dislocation. Most of our new low sulfur coal is found west of the Mississippi River or in Alaska, far from industrial areas. Also, much of the western coal is in arid or semi-arid areas where scarcity of water could constrain development.

If an alternative to the proposed OCS sale is greater reliance on coal, it may be expected that mining would increase in western states to provide the necessary fuel source.

Environmental Impact:

Coal Utilization: Combustion of coal results in various emissions, notably SO_2 and particulates. If the expected production from this sale is replaced by coal, there will be an increase in these pollutants, especially if coal is substituted for the natural gas presently used. Technology to control these emissions is available but has not yet been proven sufficient to be widely applied. The sulfur content of eastern coal varies considerably, but approximately 65 percent of the developed resources have a sulfur content exceeding 1 percent. Most of the U.S. low sulfur coal is located in the western states. Any large-scale shift to coal would require relaxation of emission regulations or improvement of technologies to convert coal to gaseous or liquid fuels.

Surface Mining: The primary impact of surface mining is disruption of the land. This affects all local flora and fauna and water quality, and it increases landscape problems due to erosion and runoff from the mine. Reclamation is difficult in the western states due to the lack of water to assist in revegetation. Other problems include acid mine water drainage, leachings from spoil piles, processing waste, and the disturbance caused by access and transportation. Noise and vibration resulting from operations can also be expected. Finally, surface mining causes conflicts with other resource uses such as agriculture, recreation, water, and wildlife habitat.

The land use of strip-mining ranges from 0.8 to 5.9 acres/10^{12} BTU extracted, depending on seam thickness and BTU content of the coal.

Underground Mining: Underground mining primarily affects land and water quality. The land impacts are those that arise from subsidence, waste disposal, access, and transportation. Very little surface is disturbed. Subsidence can destroy structures, cause landslides and earthquakes, and disrupt groundwater circulation patterns. The amount of subsidence can be controlled by the mining method used and the amount of coal removed. Both have detrimental effects on the economics of the operation.

Water quality is affected by both processing waste and the drainage of acid mine-water into surrounding areas. These can be minimized through the proper methods of control both during and after operations. Entrances can be sealed and waste piles can be replaced in the mine. This would also help minimize subsidence. There are also pollution problems associated with road and coal dust and the like, but these are minimal and easily controlled. Other disturbing aspects of mining have much less of an impact in an underground mine. Working conditions of underground mines have been improved under the Federal Coal Mining Health and Safety Act of 1969, although further efforts are needed to reduce health hazards. This program has resulted in increasing costs of underground mining relative to surface mining, which has even more severe environmental restraints and impacts.

Coal Transportation: The five major transportation systems (road, rail, water, conveyer, and pipeline) all have some adverse environmental impacts. These include air and noise pollution, safety, land use, trash disposal, and aesthetics. However, since spill problems are not associated with coal, most of the impacts can be controlled with greater care and consideration. A slurry pipeline also requires large supplies of water and must adequately dispose of this at the other end. Water availability is a problem in many areas of the U.S., especially in the west where energy resource requirements will have to compete with other existing commercial and private users for a limited and fragile supply.

Coal Conversion: Technology for conversion of coal into gaseous and liquid hydrocarbons has been established for several decades, and a number of relatively low-capacity commercial plants exist in various parts of the world. However, few cost-effective advanced technologies have progressed beyond the pilot plant stage.

Numerous problems remain before commercial development of synthetic fuels from coal can proceed. Specific technical problems must be solved. The cost effectiveness of synthetic fuels from coal will depend on prices of other fuels, primarily oil and natural gas.

The Energy Security Act of 1980 created the United States Synthetic Fuel Corporation. The corporation is empowered to provide financial assistance to the private sector for commercial synthetic fuel projects. The goal of the corporation is to increase sythetic fuel production to the equivalent of at least one-half million barrels of oil per day by 1987 and two million barrels per day by 1992.

Control of adverse environmental effects will increase the cost of producing synthetic fuels. Possible constraints on development include technological constraints, availability of skilled workers, raw materials (coal, water, steel), capital, institutional constraints government policies (energy resource leasing, coal mining regulations, permit procedures, etc.) and the willingness of industry to invest in development of new technologies.

Synthetic oil and gas could contribute substantially to energy supplies by the year 2000. The most important contributors would be high-BTU gas from coal, synthetic crude oil from oil shales, and coal liquefaction. The success of these energy sources will depend on developing technology, the cost of the impacts, and the cost of conventional oil and gas.

Coal Gasification: Gaseous fuels with low, intermediate, or high energy content can be produced. Low and intermediate gases are produced in a 2-stage process involving preparation and gasification, and the output is utilized as feedstock for electric generators. A third process, upgrading, is required to produce high-BTU gas, which produces an end product usable by the consumer.

Among low-BTU gasification processes under development are: Lurgi, Koppers-Totzek (both in commercial use), Bureau of Mines Stirred Fixed Bed, and Westinghouse Fluidized Bed. Among high-BTU gasification processes are: Lurgi High-BTU gasification process, HYGAS, BI-Gas, Synthane, and CO_2 Acceptor.

The environmental impacts of coal gasification are those of mining plus those resulting from the production processing. Gasification processes have lower primary efficiency than direct coal combustion; more coal will have to be gasified to reach an equivalent BTU output. However, it is likely that coal gasification will achieve primary efficiencies of 70 percent which is about twice that of coal to electricity end use. Water impacts of processing can be minimized by recycling and evaporation. However, large inputs of water are required for some of the technologies, thus creating the potential for conflicts in water-short areas. For example, a Koppers-Totzek gasifier producing 250×10^9 BTU per day will require water in the amount of 463,000 gallons per day and coal in the amount of 10,570 tons per day.

Air pollution could include sulfur dioxide, particulates, nitrous oxides, hydrocarbons, and carbon monoxides.

Land impacts result from solid waste disposal plus land use for the plant, coal storage, cooling sands, etc. Solid wastes include ash, sulfur, and minute quantities of some radioactive isotopes.

Coal Liquefaction: Liquified coal is expected to replace conventional crude oil as the major source of liquid fuel and provide 10 percent of total domestic energy consumption by 2020 (see Table H-5).

As with coal gasification, production of liquid fuels from coal requires either addition of hydrogen or removal of carbon from the compounds in the coal. Coal liquefaction can be accomplished by hydrogenation, pyrolysis, or catalytic conversion. Only catalytic conversion is in commercial operation. Among liquefaction processes under development are: synthoil, H-Coal, Solvent Refined Coal, Consol Synthetic Fuel, COED, TOSCOAL, and Fischer-Tropsch.

Again, the impacts of liquefaction will be those of mining and those of the processing plants. The available technologies have a recovery of from 0.5 to 3 barrels of oil per ton of coal processed.

Water effluents from liquefaction plants could contain amounts of phenols, solids, oil, ammonia, phosphates, etc. The waste water could be treated to remove most of these products.

Air pollution could result from particulates, nitrogen, sulfur oxides, and other gases. Pollution control facilities would be required but would lower the economic attractiveness of the plants.

Solid wastes would be mostly ash. Residue could be buried in the mine with little further environmental impact, if liquefaction plants are sited at the opening of the mine.

Nuclear Power-Fission: The predominant nuclear system used in the United States is the uranium dioxide fueled, light water moderated and cooled nuclear power plant. Research and development is being directed toward other types of reactors, notably the breeder reactor and fusion reactors.

Between 1970 and 1980 nuclear energy production increased from 21.8 billion kilowatt hours (1.4% of total U.S. electricity production and 0.4% of total energy production) to 251.1 billion kilowatt hours (11.0% of total U.S. electricity production and 4.2% of total energy production). Installed generating capacity increased from 6.5 million kilowatts (1.9% of U.S. total) to 56.5 million kilowatts (9.2% of U.S. total).

Due to environmental concerns the growth of nuclear energy may be slowing. At the end of 1980 there were 75 reactors in the U.S., up from 19 in 1970. Although four reactors were licensed in 1980, fourteen other planned units were cancelled, and the Nuclear Regulatory Commission closed five for modification to comply with revised seismic requirements, and shut down eight reactors comparable to Three Mile Island's to determine the probability of a similar accident and make required safety modifications. Nuclear-energy output was down 1.6 percent in 1980. There are currently 102 reactors under various stages of construction, construction permit review, or on order.

Nuclear power development has encountered delays in licensing, siting, and environmental constraints as well as manufacturing and technical problems. Future capacity will be influenced by the availability of plant sites, plant licensing considerations, environmental factors, nuclear fuel costs, rate of development of the breeder and fusion reactors, and capital costs.

Domestic uranium resources are probably plentiful. Ultimately recoverable reserves are estimated to be 6,876 million short tons, and large areas are unexplored. Twenty-one million short tons were consumed in 1980 domestic nuclear energy production.

Although fuel cycle costs of nuclear reactors have increased only slightly in recent years, present trends in reactor capital costs are significantly narrowing the economic advantage offered by fuel-cycle costs over coal- and oil-fired plants. Nuclear energy may provide up to 19 quads in 2020, 13 percent of total domestic consumption (see Table H-5).

Environmental Impact: Although nuclear plants do not emit particulates or gaseous pollutants from combustion, the potential for serious environmental problems exists. Some airborne and liquid radioactive materials are released to the environment during normal operation. The amounts released are very small, and potential exposure has been shown to be less than the average level of natural radiation exposure. The plants are designed and operated in such a way that the probability of harmful radioactivity released from accidents is very low.

Nuclear plants use essentially the same cooling process as fossil-fuel plants and thus share the problem of heat dissipation from cooling water. However, light water reactors require larger amounts of cooling water and discharge greater amounts of waste heat to the water than comparably sized fossil-fuel plants. The effects of thermal discharges may be beneficial in some though not all cases. Adverse effects can often be mitigated by use of cooling ponds or cooling towers.

Low-level radioactive wastes from normal operation of a nuclear plant must be collected, placed in protective containers, and shipped to a Federally-licensed storage site for burial. High-level wastes created within the fuel elements remain there until the fuel elements are processed. Currently, spent fuel is stored at NRC-licensed facilities. Plans call for recovering unused fuels at reprocessing plants, solidifying the wastes, and placing them in storage at a Federal Repository.

Primary residuals from light water reactors are waste heat and radioactive emissions. For a 1,000 MW(e) plant operating at a 75-percent load factor, a 33-percent-efficient nuclear plant would emit 47×10^{12} BTU's of waste heat annually. For comparison, a 40-percent-efficient fossil-fuel plant would emit 36×10^{12} BTU's of waste heat.

There are also impacts on land, water, and air quality arising from the mining of these uranium ores. Dwindling amounts of high grade reserves will increase the amounts of land mined for lower grade radioactive ores--primarily in western states. The mining operations will be similar to coal, but the nature and distribution of the deposits mean "lesser" impact while radioactive trailings cause unusual problems for disposal, the environment, and human health.

A more complete discussion of uranium mining and processing, the economics and environmental impacts, as well as nuclear fission and fusion can be found in Chapters 6 and 7 of Energy Alternatives: A Comparative Analysis.

Nuclear Power-Fusion: The controlled fusing of atoms in a reactor is a long-term alternative energy source. Scientific feasibility has yet to be proven but looks promising. Technological and commercial feasibility will have to follow, however. The main obstacles are obtaining a high enough temperature and containing the reaction. It is unlikely that fusion will be available to any significant degree before 2025.

Fusion is attractive for two reasons: abundant fuel sources and relative safety. The reaction is fueled by deuterium and tritium. Deuterium exists naturally in sea water and would be nearly cost-free. Tritium can be inexpensively produced in a reactor from lithium, which is plentiful.

Because of the small neutron activation involved in fusion reactions there would be lower radioactive inventories, fewer radioactive wastes, less serious fuel-handling problems, and differences in accident risk.

A proposed hybrid fusion-fission fuel cycle would fuel fission reactors with fusion-produced isotopes and multiply the energy release of fusion tenfold while demanding less of the fusion core, thus enhancing the safety characteristics of both reactors.

A proposed pure deuterium process, while possessing a lower reaction rate, would have a neutronless fuel cycle. Thus all particles and products would be electrically charged and there would, in theory, be no radioactivity.

Environmental Impact: The environmental risks from fusion energy are probably less than fission, but the degree of reduction, and the social acceptability of that degree, cannot be determined presently.

Oil Shale: Oil shale is a fine-grained, sedimentary rock which, when heated, releases a heavy oil that can be upgraded to synthetic crude oil. The technology for exploitation currently exists and commercial production may begin by 1984. The resource base for shale is very large, perhaps as much as 360 billion barrels.

Large areas of the United States are known to contain oil shale deposits, but those in the Green River Formation in Colorado, Wyoming, and Utah have the greatest commercial potential.

Classes one and two deposits are at least 30 feet thick, average 30 gallons of oil per ton of shale, and include only the most accessible and better defined deposits. Class three deposits are as rich as classes one and two, but more poorly defined and less favorably located. Class four deposits are lower grade, poorly defined deposits ranging down to 15 gallons of oil per ton of shale.

Environmental Impact: Oil shale development poses serious environmental problems. With surface or conventional underground mining, it is very difficult to dispose of the huge quantities of spent shale, which occupy a larger volume than before the oil was extracted. Inducing revegetation in an area of oil shale development is difficult and may take more than 10 years. In-place processing avoids many of these environmental hazards. The spent shale problem is much less severe with underground mining.

Air pollutants from the mining will come from dust and vehicular traffic. These will be predominantly particulates, followed by NO_x and CO, with minimal amounts of hydrocarbons, SO_x and aldehydes.

The mining of oil shale requires little water, both for operations and for reclaiming solid wastes. Water pollutants are considered negligible but may arise if saline water was encountered during the operations and had to be disposed of.

However, the processing (retorting) operations consume large quantities of water and generate large amounts of waste water. The waste water must be treated and can be reused in the process. Therefore, it has been assumed that water pollution will not be a problem outside the complex. However, the limited availability of input water in the development area could lead to resource use conflicts.

Air pollutants vary with the technology used. Solid waste comprises the greatest problem of oil shale processing. The volume of the waste is greater than the volume of the input. Therefore, backfilling and the like would not provide a sufficient disposal space. Finally, there are the impacts of access and of transporting the products. These are analogous to those of coal mining in the case of access, and petroleum distribution in the case of transporting the product.

A fuller description of this energy source can be found in Chapter 2 of Energy Alternatives: A Comparative Analysis.

Tar Sands: Tar sands are deposits of porous rock or sediments that contain hydrocarbon oils (tar) too viscous to be extracted by conventional petroleum recovery methods. Large-scale production efforts have been developed in Canada, but U.S. ventures have been minor. U.S. resources are concentrated in Utah, with some potentially commercial quantities in California, Kentucky, New Mexico, and Texas.

About 1.5 tons of rich tar sands yield about one barrel of tar, or bitumen, the equivilant of about 6.3×10^6 BTU's. Tar can be recovered either by surface or underground mining, or underground extraction of the oil without mining. Recovery is followed by processing, upgrading to synthetic crude, and refining.

Ultimately recoverable reserves may be 100 billion barrels, including other heavy oils.

Environmental Impact: Surface mining produces substantial residuals, including modification of surface topography, disposal of large amounts of overburden, dust and vehicle emmissions, and water pollution. Reclamation can minimize these impacts. Residuals are similar to those of coal.

The impacts of processing tar sands are similar to those of oil shale. These include solid tailings from extraction, cooling water and blowdown streams; thermal discharges, and off-gases. Under controlled conditions these residuals can be minimized.

Underground extraction without mining can result in thermal additions, contamination of aquifers, surface spills, surface earth movements, noise pollution, and emission of gases.

Hydroelectric Power: Hydropower is energy from falling water, which is used to drive turbines and thus produce electricity. Conventional hydroelectric developments convert the energy of natural regulated stream flows falling from a height to produce electric power. Pumped storage projects generate electric power by releasing water from an upper to a lower storage pool and then pumping the water back to the upper pool for repeated use. A pumped storage project consumes more energy than it generates but converts offpeak, low-value energy to high-value peak energy. A more detailed discussion of this energy source is found in Chapter 9 of the Energy Alternatives: A Comparative Analysis.

Many of the major hydroelectric sites operating today were developed in the early 1950's. Thirty to forty years ago hydroelectric plants supplied as much as 30 percent of the electricity produced in the United States. Although hydroplant production has steadily increased, thermal-electric plant production has increased at a faster rate.

From 1970 to 1980 hydroelectric power production has fluctuated slightly between 220 and 300 billion kilowatt hours, about 4 percent of total U.S. energy production. As a proportion of total U.S. electricity production and installed generating capacity, hydroelectricity has dropped from 16 to 12 percent, although the latter has increased from 55.1 to 76.4 million kilowatts. Much of the recent hydroelectric development has been pumped storage capacity.

It is likely that hydroelectric power will continue to represent a declining percentage of the total U.S. energy mix due to the following: high capital costs, seasonal variations in waterflows, land use conflicts, environmental effects, water use, and flood control constraints. Sites with the greatest production capacity and lowest development costs have already been exploited.

Environmental Impact: Construction of a hydroelectric dam represents an irreversible commitment of the land resource beneath the dam and lake. Flooding eliminates wildlife habitat and prevents other uses such as agriculture, mining, and free-flowing river recreation.

Hydroelectric projects do not consume fuel and do not cause air pollution. However, use of streams for power may displace recreational and other uses. Water released from reservoirs during summer months may change ambient water temperatures and lower the oxygen content of the river downstream, adversely affecting indigenous fish. Fluctuating reservoir releases during peak load operation may also adversely affect fisheries and downstream recreation. Screens placed over turbines prevent the entrance of fish, but small organisms may pass through and may be killed.

Fish may die from nitrogen supersaturation, which results at a dam when excess water escapes from the draining reservoir. High nitrogen levels in the Columbia and Snake Rivers pose a threat to the salmon and steelhead resources of these rivers. Other adverse impacts to water quality include possible saline water intrusion into waterways and decreased ability of the waters to accommodate waste discharges.

Air quality will only be affected by dust and emissions during the construction phase. Afterwards, if the impoundment is used for recreation, motor exhaust would occur.

Solar Energy: Applications of solar energy must take into account the following:

Solar energy is a diffuse, low intensity source requiring large collection areas. Only a small portion of the potential energy is utilized.

Its intensity is continuously variable with time of day, weather, and season.

Its availability differs widely between geographic areas.

Potential applications of solar energy show a wide range. Among them are:

- Thermal energy for buildings -
  - Water heating, space heating, space cooling, combined systems
- Renewable clean fuel sources -
  - Combustion of organic matter
  - Bioconversion of organic materials to methane
  - Pyrolysis of organic materials to gas, liquid, and solid fuels
  - Chemical reduction of organic materials to oil
- Electric power generation -
  - Thermal conversion
  - Photovoltaic - residential/commercial, ground central station, space central station
  - Wind energy conversion
  - Ocean thermal difference

Solar energy collection systems are now commercially available nationwide. Sales of collectors has risen from 1.2 million square feet in 1974 to 14.3 million square feet in 1979.

Environmental Impact: Although fuel costs for backup systems and maintenance costs for solar units are small when compared with operating costs of conventional heating and cooling systems, the high initial or "fixed" costs of solar units make them unattractive to many homeowners and builders. However, the rising cost of the gas and oil needed by the conventional heaters means that, over time, the greater fixed costs of solar systems will be balanced by their lack of fuel costs.

Large-scale generation of electricity using solar energy is another promising application which is receiving increased funding. A number of technical and engineering problems now prevent commercialization of solar steam-electric plants, though pilot projects are well under way.

Additional detail on this resource alternative is found in Chapter 11 of Energy Alternatives: A Comparative Analysis (U.S. Government Federal Policy Task Force Review Group, Solar Energy Analysis, 1978; Solar Energy Progress and Problems, 1978, EPA, U.S. DOE, and Lawrence Berkeley Laboratories, et al.).

Among the disadvantages of solar energy are high capital costs, expensive maintenance of solar collectors, thermal waste disposal, and distortion of local thermal balances.

The impacts so far identified with solar energy are relatively minimal. The primary effects of the use of this energy source on a wide scale will be land use. Due to the low density of the energy, large areas will be necessary for the collectors. However, the land use compares favorably with other forms of energy use such as coal extraction.

The only other area for concern known so far is thermal pollution. Direct use in space heating has no thermal effects. However, for solar electric power generation, heat will have to be collected and transferred to the generator.

Some localized thermal pollution may occur as a result, but the problem is not expected to be significant. Finally, solar plants can only operate intermittently. Thus, the energy will have to be either stored, or backup fossil-fuel plants will have to be built. These will have their own sets of environmental constraints.

Oil Imports: Spurred by new discoveries and competition, Middle East oil production expanded in the 50's and 60's. New markets were opened and prices softened. The real price of oil fell from 1948 to 1972.

Simultaneously, U.S. consumption of oil increased while production stayed constant; imports were relied upon to make up the difference.

In 1973 the Arab-Israeli war was accompanied by an embargo imposed by OPEC against nations supporting Israel. The vulnerability of the importers to their own heavy demand became evident, and a huge price increase followed. This marked the end of the so-called era of "cheap energy" and efforts were made to curtail imports. Another large price increase occurred in 1979.

Three avenues were pursued for reducing imports: conservation, or reduced net energy demand per unit of output; alternative energy; and increased domestic production. These are discussed elsewhere in this Appendix.

The results of these efforts for reducing imports seem to have been mostly successful. The underlying market structure for energy has been altered. World demand for oil peaked in 1977 and appears to be in an irreversible structural decline. Gross national products have been rising along with non-energy output, alternative energy sources, and non-OPEC production. Declines in energy use have been wholly oil.

OPEC produced 32 million barrels per day (mbd) in 1977 and now produces 24 million barrels daily. Current projections of energy consumption until the year 2000 show rates of half of what was projected in 1972. DOE is currently projecting a .9-percent annual growth rate (actual growth was 1.9% annually from 1970-1979), and a 3-percent annual economic growth. The dimensions of the structural change for the U.S. in 1981 are as follows:

- total energy consumption is down 5 percent.
- petroleum consumption is down (8 percent) for the third straight year.
- oil consumption as a percentage of total energy consumption is down 9 percent.

-- imports of petroleum are down for the fourth straight year. Imports in May 1981 were 5.2 mbd, the lowest in 10 years. This is 20 percent less than in 1980 and 38 percent less than in 1979.

-- imported petroleum as a percentage of total petroleum consumption is down 5 percent.

-- imported petroleum as a percentage of total energy consumption is down 27 percent.

-- quads per dollar of GNP has been steadily declining since 1970.

OPEC will probably control the bulk of the world's oil production for the remainder of the century, and, due mainly to the short-term inelasticity of supply of substitutes, set prices based on factors besides price/cost relationships. Thus the less dependent the U.S. is on OPEC, the less vulnerable the U.S. is to large, erratic price increases. Imports from the Middle East also bring problems of stability of supply, balance of payments, currency exchange rates, and U.S. offloading capacity.

The U.S. will probably remain somewhat dependent on imported energy throughout this century, and as the 70's showed, there are situations in the Middle East which could lend to major disruptions in supply or huge price increases. However, the propensity for such anomalies is less than previously due primarily to the following:

-- As mentioned above the underlying market structure for energy has been altered and demand for oil has declined drastically. Associated with this, OPEC will have considerable spare capacity and price cohesiveness will be difficult to maintain.

-- All OPEC nations need to produce oil to finanace development. The goal of many OPEC nations is to maximize oil's long-term contribution to the national economy, rather than to maximize short-term profits. If revenue falls below a certain level where they are not getting an acceptable income, domestic tensions may ensue.

-- The OPEC economies, especially Saudi Arabia's, are more interdependent with the West than previously. OPEC has invested interest and financial reserves in the West, imports from the West, and has their oil prices tied to Western currency exchange rates.

-- The presence of strategic stockpiles provides both a deterrent to intentional disruptions in world markets and a cushion for smoothing price and supply shocks. Current stockpile inventories of most Western nations are at record levels.

OPEC's output and pricing structure will also depend on their balancing of:

--future vs. present proceeds.

--benefits vs. costs of rapid modernization.

--discipline in the market vs. the political unity of OPEC.

Environmental Impact: The primary hazard to the natural environment of increased oil imports is the possibility of oilspills, which can result from accidental discharge, intentional discharge, and tanker casualties. Intentional discharges would result largely from uncontrolled unballasting of tankers. The effects of chronic, low-level pollution are largely unknown. The worldwide tanker casualty analysis indicates that, overall, an insignificant amount of the total volume of transported oil is spilled due to tanker accidents. However, a single incident such as the breakup of the Torrey Canyon in 1967 or the Amoco Cadiz in 1978 can have disastrous results. Of more concern than tanker spills is the impact to the social and economic environment. The potential for a future embargo under this option is such that American productivity and policy could become subservient to foreign influence, having both national economic and security implications. On a more subtle level, political alignments and policies of the United States could become tied to those of foreign oil powers. This option is the least acceptable for continued American energy independence.

Natural Gas Imports: Imports of natural gas via pipeline have come largely from Canada with small amounts from Mexico. In 1980, net pipeline imports from Canada were 881 billion cubic feet, about 4.4 percent of total natural gas used in the United States. These imports were about 33 percent of Canada's natural gas production.

The natural gas import situation continues to be highly uncertain. A major reason for this uncertainty is the disparity between prices for natural gas and alternative fuels in this country and the price of crude oil in world markets.

The United States and Canada concluded an agreement in March 1980 that established a formula for escalating the price of Canadian imports. The formula prices Canadian gas at the BTU-equivalent price of Canadian crude oil imports, minus an adjustment that reflects savings to Canada of certain transportation costs. In response to escalated Canadian prices, demand in the U.S. for Canadian gas dropped sharply. Consequently, Canada has foregone the opportunity to raise its export price. What modifications, if any, the Canadians will make to their pricing formula, and what minimum amounts of Canadian gas Americans must take under existing contracts, are matters currently being examined on both sides of the border.

Mexico could be a significant source of future imports because of its relatively large natural gas resource base. Imports from Mexico were of a local nature until 1957 and have declined since 1969. In September 1979, an agreement also was concluded between the U.S. and Mexico regarding the importation and pricing of natural gas. A base price was specified to be escalated in proportion to the average price of five crude oils traded on the world market. However, the rapid increase in world oil prices between the time the agreement was concluded and the time the price escalation began brought the price of Mexican gas substantially below both oil parity and the Canadian gas price. Consequently, Mexico requested and received the same price as the Canadians.

Natural gas imports are expected to be eliminated in the long run, as domestic natural gas production will nearly satisfy decreasing demand, and synthetic gas from coal can provide the balance and replace imports.

Environmental Impact: The environmental impacts of increasing gas imports derive mainly from the possible increased use of land for pipeline construction. A further impact is the risk of explosions and fires. Fluctuations of that supply could influence quality of life, productivity, and employment. American policies could also become influenced by decisions of foreign gas producers, much as they could under the option of increasing oil imports.

Liquefied Natural Gas Imports: The growing shortage of domestic natural gas has encouraged projects to import liquefied natural gas (LNG) under long-term contract. Large scale shipping of LNG is a relatively new industry. Several LNG projects are now under consideration on the Pacific, Atlantic, and Gulf Coasts. Security of foreign LNG is questionable. The complexity of the length of time involved in implementing these proposals has been increased by the need for negotiating preliminary contracts, securing the approval of the Federal Power Commission and the exporting country, and making adequate provision for environmental and safety concerns in the proposed U.S. facilities. The costs of liquifying and transporting natural gas other than overland by pipe are high.

The U.S. imported 85 billion cubic feet of LNG from Algeria in 1978. In March 1980 Algeria announced it was demanding oil price parity free on board for gas it exports to the United States, and it subsequently discontinued deliveries. The free-on-board price does not include transportation, terminal, and regasification costs, which are substantial. Negotiations with Algerians are in progress.

Environmental Impact: The environmental impacts of LNG imports arise from tankers; terminal, transfer, and regasification facilities; and transportation of gas. The primary hazard of handling LNG is the possibility of a fire or explosion during transportation, transfer, or storage.

Receiving and regasification facilities will require prime shoreline locations and dredging of channels. Regasification of LNG will release few pollutants to the air or water.

LNG imports will influence the U.S. balance of payments. This impact will depend on the origin and purchase price of the LNG, the source of the capital, and the country (U.S. or foreign) in which equipment is purchased and LNG tankers are built.

Geothermal Energy: Geothermal energy is primarily heat energy from the interior of the earth. It may be generated by radioactive decay of elements such as uranium or thorium, and friction due to tidal or crustal plate motions.

There are 4 major types of geothermal systems: hot water, vapor dominated, geopressured reservoirs, and hot dry rock systems.

In addition to electricity, geothermal energy can offer a potential for space heating, industrial processing, and other nonelectric uses in many areas which presently are highly dependent upon oil and gas for energy needs. However, geothermal electric generating plants are smaller than conventional plants and require a greater amount of steam to generate the equal amount of energy. This is due to the fact that temperatures and pressures associated with geothermal areas are lower than those created at conventional poser plants. In some areas, geothermal resources may have potential for space heating, industrial processing, and other nonelectric uses.

The greatest potential for geothermal energy in the U.S. is found in the Rocky Mountain and Pacific regions; some potential exists in the Gulf Coastal Plain of Texas and Louisiana. The geyser field in California is the most extensively developed source of geothermal energy in the U.S. It has been producing power since 1969. Exploration efforts are also underway in the Imperial Valley, Salton Sea, Mono Lake, and Modoc County, California.

Between 1970 and 1980 geothermal production increased from 525 to 5,073 million kilowatt hours, and installed generating capacity increased from 84 to 1,005 kilowatts. Geothermal energy presently accounts for less than 1 percent of total U.S. energy production.

Environmental Impact: A number of gases are associated with geothermal systems and may pose health and pollution problems. These gases include ammonia, boric acid, carbon dioxide, carbon monoxide, hydrogen sulfide, and others. However, adverse air quality impacts are generally less than those associated with fossil-fuel plants. Also associated with geothermal energy systems are saline waters which must be disposed of and isolated from contact with ground water regimes.

Land quality problems stem from disturbance due to construction of related facilities and possible ground subsidence which, in turn, can cause structural failures and loss of ground water storage capacity.

Other Energy Sources: The high cost and rapidly shrinking reserves of the traditional energy fuels have encouraged research into new and different sources for potential energy. Some of these alternate sources have been known for decades, but high costs and technical problems have prevented their widespread use. They include tidal power, wind power, organic fuels, and ocean thermal-gradients, among others. These sources are expected to account for up to 13 percent of total domestic energy consumption by 2020 (see Table H-5).

Environmental impacts of these alternatives are difficult to assess, especially as a great amount of research and development remains to be completed before operational scale systems can be developed, tested, and evaluated for production and application.

The date of commercial availability of such alternatives will depend on the cost of the traditional energy fuels, the level of Federally subsidized research through ERDA assistance, and the solution of engineering and technical problems.

Combination of Alternatives: A combination of some of the most viable energy sources available to this area, discussed above, could be utilized to attain an energy equivalent comparable to that estimated to be produced within the field life anticipated by this proposed action. However, this combination of alternatives, in order to attain the needed energy mix peculiar to the infrastructure of this area, would have to consist of energy sources attainable now or within the timeframe that are transferable to the technology presently used, i.e., viable substitutes would have to be available for the petroleum and natural gas required by the petrochemical industrial complex, the petroleum used for the transportation sector, and the electricity and fuels used in residential and commercial sectors.

Part II of the Energy Alternatives: A Comparative Analysis, particularly Chapter 16, "Comparing the Economic Costs of Energy Alternatives," discusses the factors that must be involved in developing technically and economically appropriate energy alternatives.

Tables H-1, H-2, and H-3 display U.S. production, consumption, and net imports of energy by type, 1970-1980. The most noteworthy change in energy to occur in the 1970's was the enormous increases in the prices of fossil fuels (see Table H-4).

These were caused mainly by the large increases in crude oil prices set by OPEC in 1974 (357 percent) and in 1980 (95 percent). OPEC controls the bulk of the world's oil production and can set market prices based on factors other than price/cost relationships. Increases in the prices of substitutes, gas and coal, followed.

Thus, while the amounts produced, consumed, and imported did not change drastically (although crude oil consumption and imports did rise and fall), their value did increase substantially.

Table H-5 displays the Department of Energy's (1980 Annual Report to Congress) projections of domestic energy production and consumption, by type, 1985 to 2020. DOE prepared three series of projections, each a function of a distinct time path (low, medium, or high) for the price of international (imported) oil. As even the low price time series assumes (slight) real price increases (prices rising faster than the general inflation rate), Table H-5 displays the low price projections, given the considerations regarding OPEC's waning price-setting strength stated previously.

The most viable domestically available energy alternatives, technologies and economies allowing, would probably consist of the use of coal, oil shale, tar sands, and biomass to produce synthetic liquids, nuclear energy, and coal to compete for the utility market, and renewables to supply a sizeable portion of total energy requirements. The environmental impacts of each of these alternatives have been discussed briefly in the previous sections. The result will be a long-term energy supply transition from crude oil and less dependence on oil imports. Such patterns will require new efficient technologies, major capital investments, and a high rate of growth in coal production.

The future U.S. energy source mix will depend on a multiplicity of factors, among them the identification of resources, research and development efforts, development of technology, rate of economic growth, the economic climate, changes in lifestyle and priorities, capital investment decisions, energy prices, world oil prices, environmental quality priorities, government policies, and availability of imports.

It is unlikely that there will ever be a single definitive choice between energy sources, or that development of one source will preclude development of others. Different energy sources will differ in their rate of development and the extent of their contribution to total U.S. energy supplies. Understanding of the extent to which they may replace or complement offshore oil and gas requires reference to the total national energy picture. Relevant factors are:

> Historical relationships indicate that energy requirements will grow in proportion to the gross national product.
>
> Energy requirements can be constrained to some degree through the price mechanisms in a free market or by more direct constraints. One important type of direct constraint operating to reduce energy requirements is through the substitution of capital investment in lieu of energy, e.g., insulation to save fuel. Other potentials for lower energy use have more far-reaching impacts and may be long range in their implementation--they include rationing, altered transportation modes, and major changes in living conditions and lifestyles. Even severe constraints on energy use can be expected to only slow, not halt, the growth in energy requirements within the timeframe of this statement.
>
> Energy sources are not completely interchangeable. For example, solid fuels cannot be used directly in internal combustion engines. Fuel conversion potentials are severely limited in the short term, although somewhat greater flexibility exists in the longer run and generally involves choices in energy-consuming capital goods.
>
> The principal competitive interface between fuels is in electric power plants. Moreover, the full range of flexibility in energy use is limited by environmental considerations.
>
> Regulation of oil and gas prices lowered the price below the product level that refiners (and consumers) paid for domestic oil, and prevented the incremental cost of all domestic producing fields from equating to the price of imports. This impaired the economy's ability to adjust to world energy prices: underproduction of domestic oil, overconsumption of imports, and impediments to alternative energy. Under deregulation the real prices of oil and gas will be closer to the marginal costs of alternative energy.
>
> A broad spectrum of research and development is being directed to energy conversion--more efficient nuclear reactors, coal gasification and liquefaction, liquefied natural gas (LNG), and shale retorting, among others. Several of these could assume important roles in supplying future energy requirements, though their future competitive relationship is not yet predictable.

Table H-1
U.S. Production of Energy by Type
1970-1980

	Coal			Crude Oil[1]			NGPL[2]			Natural Gas (Dry)		
Year	Quads	Percent of Total Production	Percentage Change from Previous Year	Quads	Percent of Total Production	Percentage Change from Previous Year	Quads	Percent of Total Production	Percentage Change from Previous Year	Quads	Percent of Total Production	Percentage Change from Previous Year
1970	15	24	---	20	32	---	3	5	---	22	35	---
1971	14	23	-7.1	20	32	0	3	5	0	22	35	0
1972	14	22	0	20	32	0	3	5	0	22	35	0
1973	14	23	0	19	31	-5.3	3	5	0	22	35	0
1974	14	23	0	19	31	0	2	3	-50	21	34	-4.8
1975	15	25	7.1	18	30	-5.6	2	3	0	20	33	-5.0
1976	16	27	6.7	17	28	-5.9	2	3	0	19	32	-5.3
1977	16	27	0	17	28	0	2	3	0	20	33	5.3
1978	15	25	-6.7	18	30	5.9	2	3	0	19	31	-5.3
1979	18	28	20.0	18	28	0	2	3	0	20	31	5.3
1980	19	29	5.6	18	28	0	2	3	0	20	31	0
Avg. Annual Growth			2.4%			1.1%			-4.1%			-1.0%

Table H-1
U.S. Production of Energy by Type
1970-1980
(cont.)

	Hydroelectric Power[3]			Nuclear Electric Power			Other[4]			Total Energy Produced	
Year	Quads	Percent of Total Production	Percentage Change from Previous Year	Quads	Percent of Total Production	Percentage Change from Previous Year	Quads	Percent of Total Production	Percentage Change from Previous Year	Quads	Percentage Change from Previous Year
1970	3	5	---	0	0	---	0	0	---	63	---
1971	3	5	0	0	0	0	0	0	0	62	-1.6
1972	3	5	0	1	2	0	0	0	0	62	-1.6
1973	3	5	0	1	2	0	0	0	0	62	-1.6
1974	3	5	0	1	2	0	0	0	0	61	-1.6
1975	3	5	0	2	3	100	0	0	0	60	-1.7
1976	3	5	0	2	3	0	0	0	0	60	0
1977	2	3	0	3	5	50	0	0	0	60	0
1978	3	5	0	3	5	0	0	0	0	61	1.6
1979	3	5	0	3	5	0	0	0	0	64	4.9
1980	3	5	0	3	5	0	0	0	0	65	1.6
Avg. Annual Growth			0%			14.7%			0%		0.3%

Source: Energy Information Administration.

[1] Includes lease condensate.
[2] Natural gas plant liquids.
[3] Includes industrial and utility production of hydropower.
[4] Includes geothermal power and electricity produced from wood and waste.

Table H-2
U.S. Consumption of Energy by Type
1970-1980

	Coal			Natural Gas (Dry)			Petroleum			Hydroelectric Power[1]		
Year	Quads	Percent of Total Consumption	Percentage Change from Previous Year	Quads	Percent of Total Consumption	Percentage Change from Previous Year	Quads	Percent of Total Consumption	Percentage Change from Previous Year	Quads	Percent of Total Consumption	Percentage Change from Previous Year
1970	13	19	---	22	33	---	30	45	---	3	4	---
1971	12	18	-8.3	22	32	0	31	46	3.3	3	4	0
1972	12	17	0	23	32	4.5	33	46	6.5	3	4	0
1973	13	17	8.3	23	31	0	35	47	6.1	3	4	0
1974	13	18	0	22	30	-4.5	33	45	-6.1	3	4	0
1975	13	18	0	20	28	-10.0	33	46	0	3	4	0
1976	14	19	7.7	20	27	0	35	47	6.1	3	4	0
1977	14	18	0	20	26	0	37	49	5.7	3	4	0
1978	14	18	0	20	26	0	38	49	2.7	3	4	0
1979	15	19	7.1	21	27	5.0	37	47	-5.7	3	4	0
1980	16	21	6.7	20	26	-5.0	34	45	-8.8	3	4	0
Avg. Annual Growth			2.1%			-1.0%			1.3%			0%

Table H-2
U..S. Consumption of Energy by Type
1970-1980
(cont.)

	Nuclear Electric Power			Other[2]			Total Energy Consumed	
Year	Quads	Percent of Total Consumption	Percentage Change from Previous Year	Quads	Percent of Total Consumption	Percentage Change from Previous Year	Quads	Percentage Change from Previous Year
1970	0	0	---	0	0	---	67	---
1971	0	0	0	0	0	0	68	1.5
1972	1	1	---	0	0	0	72	5.9
1973	1	1	0	0	0	0	75	4.2
1974	1	1	0	0	0	0	73	-2.7
1975	2	3	100	0	0	0	71	-2.8
1976	2	3	0	0	0	0	75	5.6
1977	3	4	50	0	0	0	76	1.3
1978	3	4	0	0	0	0	78	2.6
1979	3	4	0	0	0	0	79	1.3
1980	3	4	0	0	0	0	76	-3.9
Avg. Annual Growth			14.7%			0%		1.3%

Source: Energy Information Administration

[1] Includes industrial and utility production, and net imports of electricity.

[2] Includes geothermal power, electricity produced from wood and waste, and net imports of coal coke.

Table H-3
U.S. Net Imports of Energy by Type, 1970-1980

	Coal		Crude Oil and Refined Petroleum Products[1]		Natural Gas (Dry)		Electricity		Coal Coke		Net Imports		Imports as Percentage of Total Energy Consumed	
Year	Quads	Percentage Change from Previous Year	Quads	Percentage Change from Previous Year	Quads	Percentage Change from Previous Year	Quads	Percentage Change from Previous Year	Quads	Percentage Change from Previous Year	Quads	Percentage Change from Previous Year	Percentage	Percentage Change from Previous Year
1970	-2	---	7	---	1	---	0	---	0	---	6	---	9.0	---
1971	-2	0	8	14.3	1	0	0	0	0	0	7	16.7	10.3	14.4
1972	-2	0	10	25.0	1	0	0	0	0	0	9	28.6	12.5	21.4
1973	-1	100	13	30.0	1	0	0	0	0	0	13	44.4	17.3	38.4
1974	-2	-100	12	-8.3	1	0	0	0	0	0	12	-8.3	16.4	-5.5
1975	-2	0	13	8.3	1	0	0	0	0	0	12	0	16.9	3.0
1976	-2	0	15	15.4	1	0	0	0	0	0	15	25.0	20.0	18.3
1977	-1	100	18	20.0	1	0	0	0	0	0	18	20.0	23.7	18.5
1978	-1	0	17	-5.9	1	0	0	0	0	0	17	-5.9	21.8	-8.7
1979	-2	-100	17	0	1	0	0	0	0	0	17	0	21.5	-1.4
1980	-2	0	13	-30.8	1	0	0	0	0	0	12	-41.7	15.8	-36.1
Avg. Annual Growth		0%	6.4%			0%		0%		0%		7.2%		5.8%

Source: Energy Information Administration.

---

[1] Includes crude oil, lease condensate, imports of crude oil for the Strategic Petroleum Reserve, refined petroleum products, unfininshed oils, natural gasoline, and plant condensate.

Table H-4
Prices of Domestically Produced Fossil Fuels
(Cents[1] Per Million BTU's)

	1970	1980	Avg. Ann. Increase	1960-1970 Avg. Ann. Increase
Crude Oil	59.9	206.0	13.1%	-1.6%
Natural Gas	16.9	76.9	16.4%	-0.5%
Coal[2]	27.9	64.9	8.8%	-1.5%

Source: Energy Information Administration.

[1] Constant 1972 dollars.
[2] Bituminous coal and lignite.

Table H-5
Projected U.S. Energy Production and Consumption, by Type
1985-2020
Low Oil Price Scenario

	1985		1990		1995		2000	
	Quads	Percentage of Total Consumption	Quads	Percentage of Total Consumption	Quads	Percentage of Total Consumption	Quads	Percentage of Total Consumption
Domestic Energy Supply								
Liquid Fuels								
Conventional Crude Oil[1/]	17.8	22.3	16.7	18.7	16.5	16.7	16.1	15.1
Enhanced Recovery	1.2	1.5	2.0	2.2	2.9	2.9	3.3	3.1
Shale Oil and Tar Sands	.0	.0	0.1	0.1	0.5	0.5	1.0	0.9
Synthetic (from coal)	.0	.0	.0	.0	.0	.0	1.4	1.3
Liquids from Biomass	.0	.0	.0	.0	.0	.0	0.3	0.3
Total	19.0	23.8	18.8	21.1	19.9	20.2	22.1	20.7
Gaseous Fuels								
Conventional Natural Gas	17.1	21.4	16.1	16.1	15.9	16.1	11.3	10.6
Enhanced Recovery	.0	.0	.0	.0	.0	.0	5.6	5.3
Synthetic (from coal)	.0	.0	.0	.0	.0	.0	0.2	0.2
Total	17.1	21.4	16.1	18.0	15.9	16.1	17.1	16.0
Coal[2/]	22.8	28.5	30.3	33.9	37.9	38.4	38.0	35.6
Nuclear	5.6	7.0	8.0	9.0	9.1	9.2	11.1	10.4
Other[3/]	3.4	4.3	3.6	4.0	4.1	4.2	10.2	10.0
Total Domestic Production	67.9	85.0	76.8	86.0	86.9	88.0	98.6	92.6
Imports								
Net Oil Imports	12.7	15.9	14.1	15.8	14.1	14.3	10.6	9.9
Net Gas Imports	1.5	1.9	1.1	1.2	1.3	1.3	1.0	0.9
Net Coal Imports	-2.2	---	-2.7	---	-3.6	---	-3.7	---
Total Net Imports	12.0	15.0	12.5	14.0	11.8	12.0	7.9	7.4
Total Consumption	79.9	100.0	89.3	100.0	98.7	100.0	106.6	100.0

[1/] Includes NGPL.
[2/] Does not include coal used for synthetic oil and gas.
[3/] Includes hydroelectric, geothermal, solar, wind, and biomass. Does not include liquids from biomass.

Source: Energy Information Administration.

Table H-5
Projected U.S. Energy Production and Consumption, by Type
1985-2020
Low Oil Price Scenario (continued)

	2010		2020		Avg. Ann. Growth 1985-2000 (Percentage)	Avg. Ann. Growth 2000-2020 (Percentage)
	Quads	Percentage of Total Consumption	Quads	Percentage of Total Consumption		
Domestic Energy Supply						
Liquid Fuels						
Conventional Crude Oil[1]	12.5	10.1	7.9	5.6	-0.7	-3.6
Enhanced Recovery	3.7	3.0	3.0	2.1	7.0	-0.5
Shale Oil and Tar Sands	2.2	1.8	3.1	2.2	16.6	5.8
Synthetic (from coal)	6.8	5.5	14.8	10.4	---	12.5
Liquids from Biomass	0.5	0.4	0.8	0.6	---	5.0
Total	25.7	20.9	29.6	20.8	1.0	1.5
Gaseous Fuels						
Conventional Natural Gas	8.7	7.1	6.3	4.4	-2.8	-3.0
Enhanced Recovery	7.0	5.7	7.6	5.3	---	1.5
Synthetic (from coal)	0.7	0.6	1.3	0.9	---	9.8
Total	16.4	13.3	15.2	10.7	.0	-0.6
Coal[2]	47.7	38.7	59.5	41.8	3.5	2.3
Nuclear	16.3	13.2	19.1	13.4	4.7	2.8
Other[3]	13.5	11.0	18.4	12.9	7.6	3.0
Total Domestic Production	119.6	97.1	141.7	99.6	2.5	1.8
Imports						
Net Oil Imports	6.9	5.6	4.3	3.0	-1.2	-4.6
Net Gas Imports	0.4	0.3	0.1	0.1	-2.7	-12.2
Net Coal Imports	-3.8	---	-3.9	---	-3.5	-0.3
Total Net Imports	3.5	2.9	0.5	0.4	-2.8	-14.8
Total Consumption	123.2	100.0	142.3	100.0	1.9	1.5

---

[1] Includes NGPL.

[2] Does not include coal used for synthetic oil and gas.

[3] Includes hydroelectric, geothermal, solar, wind, and biomass. Does not include liquids from biomass.

Source: Energy Information Administration.

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